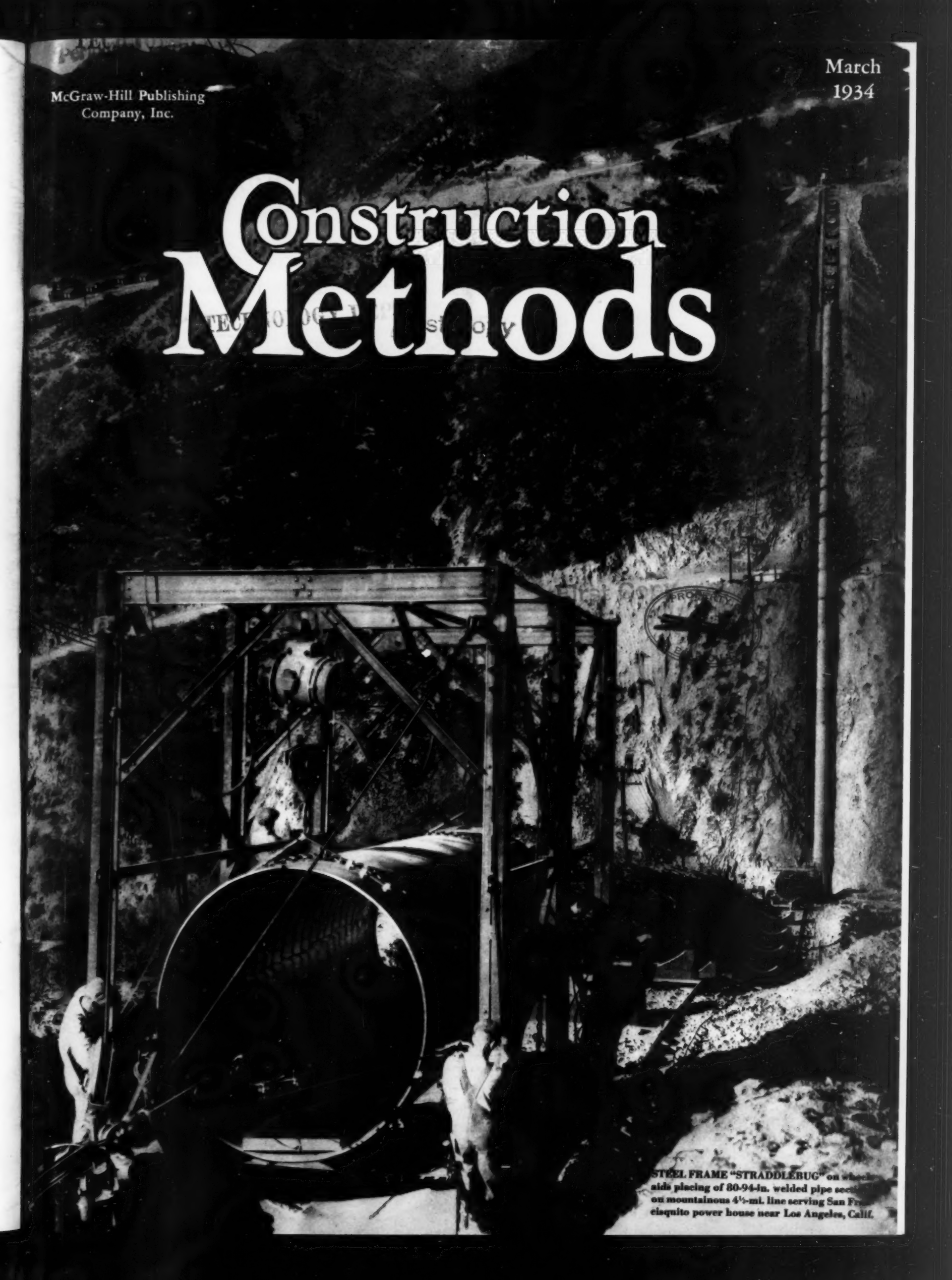


McGraw-Hill Publishing  
Company, Inc.

March  
1934

# Construction Methods



STEEL FRAME "STRADDLEBUG" on which  
aids placing of 80-94-in. welded pipe section  
on mountainous  $4\frac{1}{2}$ -mi. line serving San Francisco  
power house near Los Angeles, Calif.

# Casualty Insurance

*should fit the Specifications of your Contract*

Casualty insurance that accurately fits the specifications of your contract—casualty insurance that accurately covers not only your own legal obligations, but also the obligations assumed by you in your contract with the owner.

Such insurance you can secure by direct consultation with the Home Office underwriters of this Company. A qualified representative will call promptly if you write our Home Office.

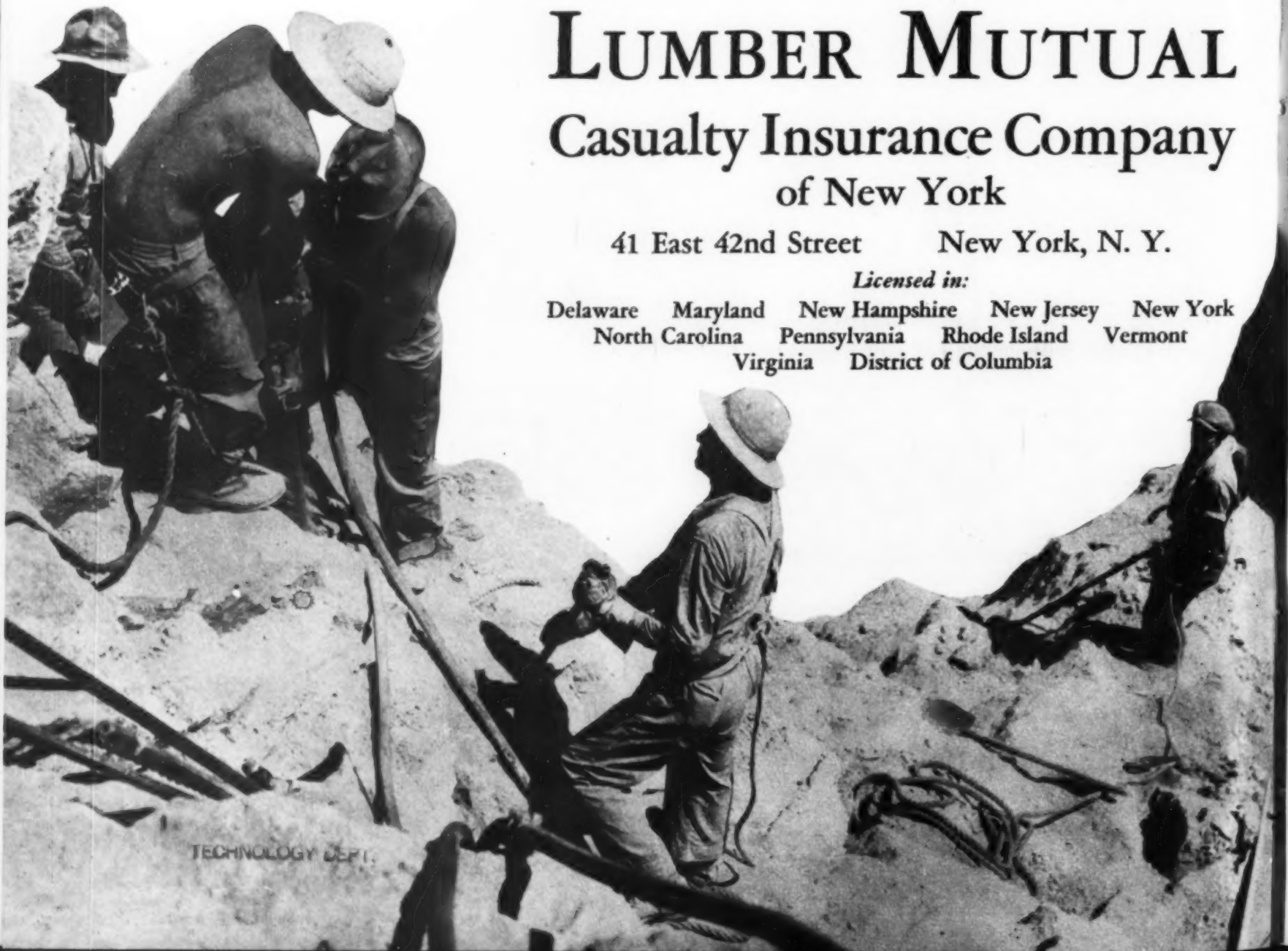
We write Workmen's Compensation, Automobile and the various forms of Public Liability and Property Damage insurance.

## LUMBER MUTUAL Casualty Insurance Company of New York

41 East 42nd Street New York, N. Y.

*Licensed in:*

Delaware Maryland New Hampshire New Jersey New York  
North Carolina Pennsylvania Rhode Island Vermont  
Virginia District of Columbia



TECHNOLOGY DEPT.



## Code Authority Organized

● The construction industry lost no time in organizing its Code Authority, provided for in the basic code of fair competition (Chapter 1) which the President signed Jan. 31 and which became effective March 2. At a meeting in Washington Feb. 15 the twenty national associations of contractors, subcontractors, engineers and architects sponsoring the code named their representatives to the important body that will administer the code provisions. Headed by Stephen F. Voorhees, who served with distinction as chairman of the committee of the Construction League of the United States which drafted the code, the newly created Code Authority is notable for the high character of its personnel.

Assurance that its difficult task of industrial self-regulation under government supervision will be fairly and efficiently handled is given by the selection of such men as A. C. Tozzer, N. F. Helmers, A. E. Horst and R. E. O'Connor as representatives of the Associated General Contractors of America; Col. John P. Hogan, for the American Society of Civil Engineers; William Stanley Parker, for the American Institute of Architects; Louis E. Guyott, for the American Road Builders' Association; and others, including F. P. Byington, representing the various subcontractor groups. The Code Authority faces a grave responsibility. With it, however, is coupled an opportunity for outstanding achievement in making the term "construction industry" mean what it implies — a coordinated, powerful whole, rather than a loosely knit group of separate elements often working at cross-purposes.

## Divisional Code for Contractors

● Under the all-inclusive Chapter 1 of the construction code, which became effective for the entire industry March 2, the first of the divisional codes, designated as Chapter 2 and applying to general contractors, received Presidential approval Feb. 17 and becomes effective March 19. For general contractors all of the provisions of the basic code, or Chapter 1, (as outlined in *Construction Methods* last month) apply, in addition to the specific terms of Chapter 2, of which the more important sections are summarized below:

### General Contractor Defined

● By code definition a general contractor is any individual, partnership, corporation, association or any other agency that undertakes, either directly or through others, the construction, modification or repair of any fixed structural or physical improvement costing \$1,000 or more.

### Code Administration

● Administration will be by a Divisional Code Authority for General Contractors, composed of 17 members, of whom 12 will be appointed annually by

# Construction Methods

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ROBERT K. TOMLIN, Editor

Editorial Staff: Vincent B. Smith, N. A. Bowers (San Francisco)

Leonard H. Church (Cleveland), Nelle Fitzgerald

WILLARD CHEVALIER, Publishing Director

## NOT AN EASY THING TO SLOW DOWN



Shoemaker, in The Chicago Daily News

## Journey's End for CWA

AS a measure of emergency relief, providing temporary employment and wages, instead of doles, for destitute men, the operations of the Civil Works Administration, wasteful and inefficient as they have been, have served a useful purpose during a national crisis. With the gradual passing of the emergency that led last year to the diversion of Public Works Administration funds to the CWA, the activities of the latter organization should be terminated at the earliest possible date; May 1 has been designated as the deadline for complete demobilization. By that time the Public Works program, a recovery rather than a relief measure, should be putting men back to work through normal channels, not only in the field but also in the mines, the mills and the factories of the capital-goods industries that serve construction and that contributed so heavily to the ranks of the unemployed.

The Public Works program today stands at the threshold of great accomplishment. Its period of organization and allocation is behind it; the period of vigorous prosecution is at hand. The hundreds of millions of dollars made available during the fall and winter and now under contract for immediate expenditure are destined to contribute mightily to the upswing of trade and employment that already is making itself felt throughout the nation.

the executive committee of the Associated General Contractors of America from its board of governors and 5, not members of the A. G. C., to be selected by the 12 appointees above chosen.

Among other duties, including those specified in Chapter 1, the Divisional Code Authority is authorized to require the registration of all construction work exceeding \$2,000 in value and to collect a registration fee of not more than one-tenth of one per cent of the value of the work, to defray code administration costs. Under the Divisional Code Authority there will be, for each of the sub-divisions, an Administrative Committee to study and report on trade practices, to receive and adjust complaints and to prescribe bidding rules. The Administrative Committee may require the inclusion in each bid of all direct and indirect costs, properly defined.

### Bidding Practices

● To insure fair competition the General Contractors' Divisional Code, among other regulations, prohibits alternate proposals, unless all bidders have the privilege of submitting them, acceptance of special privileges or favors, revision of a bid after bids have been opened, bidding upon private work upon which bids have already been opened or at any time within 90 days next thereafter (except in the case of substantial changes in plans and specifications). The code requires from bidders prequalification as to capital, organization, experience and equipment. A general contractor must maintain an adequate system of records and accounts to show allocation of funds received or disbursed for specific projects.

### Contractual Agreements

● The following contractual agreements are recognized as fair trade practices: Guaranteed price, cost of work plus a fee, unit price, lump sum and "other contractual methods not inimical to the public interest."

Funds received by a general contractor for work performed must be applied, first, to paying employees, material men, subcontractors and others.

A general contractor shall not give or accept rebates, refunds, allowances, unearned discounts or special services to or from subcontractors, material vendors or others which are not extended under like terms and conditions to or by other subcontractors, material vendors or others of equal credit rating. No financing of a general contractor's accounts by subcontractors or material vendors is permitted, unless such arrangement is expressly provided for in the original contract between the parties.

### Ban on "Kick Back"

● A general contractor shall accept no rebates, directly or indirectly, on wages, nor give anything of value or extend favors to any person for the purpose of influencing rates of wages or working conditions of his employees.

# Hang Together or Hang Separately

**D**URING 1930 the American people spent more than \$10,000,000,000 on motor car transportation. That was for private cars only; it did not include fares on common carriers. Between 1919 and 1930 this expenditure more than doubled. In 1930 it accounted for more than 10 per cent of the national income; in the American budget it ranked third, topped only by those for food and for housing.

Consider the significance of this expenditure in terms of expanding employment for men, women and capital: the building and maintenance of streets and highways; the manufacture, transportation and servicing of motor cars, tires and many other accessories; the production and distribution of gasoline and lubricants; the conduct of filling stations; the construction and operation of garages and other parking facilities, of tourist camps and wayside stands; additional staffs for hotels and insurance companies. There are many more. Can anyone doubt the dominating importance of highway transport in our national economy?

Can there be doubt, either, as to the essential role of highway development in making possible all this employment? It provides the indispensable track for the motor car. As arteries of transportation, the highways circulate the life-blood of millions who derive their livings from some one of the many industries that depend on them. The modern highway has made possible the motor transport industries; on its continued development must depend their survival.

Today, whether or not they are aware of it, these industries face a crisis. To some of their people this may not be evident, preoccupied as they are with an immediate and pressing demand for their products to make good the deferred replacement of the last three years. But once this buying wave has passed, they will have to deal with conditions that will be determined by what happens to the highways during the next couple of years. If, on that day of reckoning, highway development has been carried aggressively forward, motor transport will continue its progress. If, on the other hand, it has been permitted to languish they will face a selling problem more exacting than any they ever have known.

Let us remember always that the highway program is nowhere near completion. Of the 3,000,000 miles of rural highways, less than one-third are even surfaced. Of the surfaced mileage less than 150,000 miles are of a high type. Forty-two per cent of the farms still must rely on dirt roads.

Nor is the need merely one of more mileage. Thousands of miles of main trunk highways on some of the pioneer routes are outworn, obsolete or inadequate. They must be rebuilt, sometimes relocated, for modern alignment, gradients and traffic control. On some stretches congestion is costing the public heavily, elsewhere the requirements of sheer safety demand reconstruction.

On these and many other counts the general welfare and the recovery effort require a continuance of highway development. Misguided agitation to economize at the expense of highway improvement is a calamity; the conduct of highway work by primitive methods to increase employment in the field, at the expense of that in the shops and factories, tends to undermine the recovery effort; the diversion of registration fees and gasoline taxes from highway improvement to promiscuous uses has become little short of a public scandal; unless they are checked the organized efforts to penalize highway transport by inequitable taxation and obstructive regulation may scuttle these far-reaching industries.

In every state work is required to conserve the state and local highway program; in Washington work is required to insure an additional highway appropriation under the PWA program and to restore the regular Federal Aid appropriation. On every hand is work to be done; in that effort is a place for every element that has a stake in highway transport.

Not one of them can afford to evade its responsibility. As one of the patriot fathers put it: If they do not hang together now they surely will hang separately later.

*Willard Chevalier*

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# Do you have the **FOURTH ACE** ON THE JOB? ★ ★ ★ ★

**ARE YOU** realizing on the maximum efficiency of your shovel—the skill of your shovel operator? Is the power and speed of your tractors and the experience of their drivers being utilized to your greatest advantage?

Today, the margin between profit and loss in earth moving is mighty narrow. The only *sure* protection of profits lies in *balanced job equipment*. In order to capitalize on Shovel Efficiency—Tractor Power and Operating Skill, the job's *Fourth Ace* is all important.

The Euclid Tu-Way is the proved—profit winning *Fourth Ace*. It hauls big *Capacity Loads*—and stands the gaff of heavy Rock and Dirt moving.



... THESE TU-WAY FEATURES  
achieve greater *hauling efficiency* . . enable  
*faster operation of other equipment!*

**THE** Shovel Operator likes the wide flaring body—it's an easy target for fast dipper swinging.

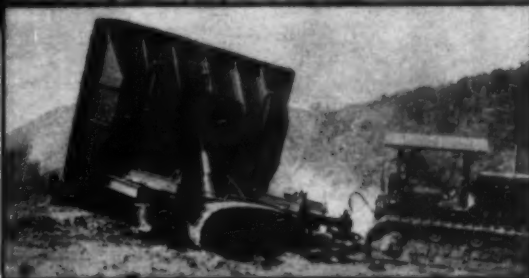
The slanting sides pack the load tighter—minimizing voids—insures capacity loads.

The Tractor Driver finds that the short turning radius (22 ft.) means quick and easy spotting under the dipper—that loads can be dumped over the ends of narrow fills better than with a rear-end dump unit.

Contractors see *surer Profits* in the fast trips from the shovel to the dump. The sturdy one-piece body construction with its minimum dead-weight, plus the free rolling Track-Wheels makes it easy for the tractor to haul capacity loads at high speeds.

No time is lost at the dump for the tractor driver controls a Hydraulic Jack which dumps the load—without stopping—to either side, and free of the tracks—spreading it as desired.

Write for Job Facts of Tu-Way Performance . . . they're interesting.



## THE EUCLID ROAD MACHINERY CO.

CLEVELAND OHIO ●

# "WITH TWO



↑ A Thew-Lorain shovel, powered by a "Caterpillar" Diesel Engine, loads into wagons pulled by "Caterpillar" Diesel Tractors, to cut coal stripping costs for a Pennsylvania producer.

## 'CATERPILLAR' DIESELS OUR FUEL

### SAVING IS \$748.80 PER MONTH"

• • *says Clarence Crow of Crow Brothers, Southern California contractors, working 16 hours per day, 26 days per month, saving 90c per hour on fuel with each tractor.*

Fuel economy—the economy of using low-price fuel and less of it — brings worth-while savings on every job, big or small. That's why "Caterpillar" Diesel Tractors are sweeping into favor with tractor users everywhere. That's why "Caterpillar" Diesel Engines are being employed by so many stationary power users, and have been adopted by builders of shovels, drag lines, gravel plants, locomotives and other equipment, to power their machines. Fuel economy — plus easy operation, simplicity, stamina. Ask for full information. Caterpillar Tractor Co., Peoria, Illinois, U. S. A.

## AMERICA GOES DIESEL



↓ "Casting-in" with a "Caterpillar" Elevating Grader on road work, this "Caterpillar" Diesel Seventy-Five Tractor moves 4000 yards per day at a fuel cost of \$2.48.

↑ Pushing a "trailbuilder" blade, this "Caterpillar" Diesel Tractor makes a new mountain road at a fuel-cost about one-quarter that of a gasoline tractor.





# A New Deal in Steel Forms for Concrete Work

*Right:— Koppel Improved Steel Forms on the 16' Mill Creek Sewer Job at Dallas, Texas — Lindb-Gustafson and Klopfer, Contractors.*



Your estimated costs on many jobs involving concrete construction will not be complete unless you have figures on Koppel Improved Steel Forms. Many contractors have found that it pays to go even further than this before bidding on a job — to discuss form requirements in detail with our engineers because Koppel has introduced new features in steel form design — features that have proved in actual service to be money savers.

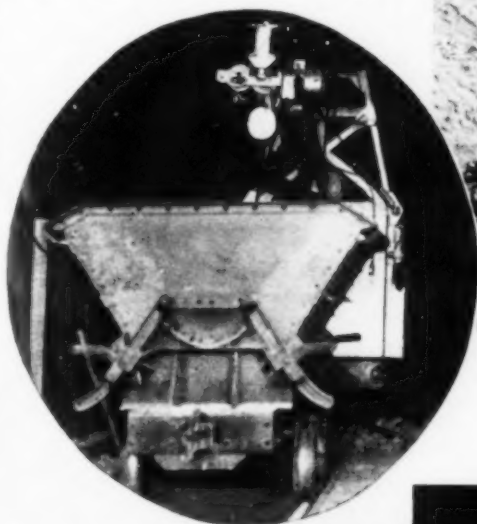
Also many contractors and construction engineers still think largely in terms of wooden forms where concrete work is involved. Whatever may have been the reason for this in the past, we invite an open mind on the subject pending investigation of important improvements in all steel forms developed and introduced by Koppel during the past two years.



*Left: — Koppel Improved Steel Forms on the big Colorado River Aqueduct job in California. These are the first steel forms purchased for this immense project and are in use by the Metropolitan Water District of Southern California at Fan Hill—16'0" diameter conduit and 12'4" diameter siphon.*



Other Koppel products include cars of all kinds for every construction purpose.



*This 4 yard rocker car is one of several types of Koppel cars giving uniformly satisfactory results on the Colorado River Aqueduct job in Southern California. The picture shows section of Whitewater Tunnel being bored by West Construction Company.*



*Complete information will be sent on request or, if preferred, an experienced Koppel engineer will call, without obligation.*

**KOPPEL INDUSTRIAL CAR & EQUIPMENT CO.**

**General Office: KOPPEL, PA.**

**NEW YORK**

**CHICAGO**

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1920

*Ida-Maybee Road, Monroe County, Michigan. Water-bound macadam maintained with Tarvia since 1920. The Eighteenth Amendment went into effect that year. Upper photo was taken in 1920; lower photo shows condition of road today, proof that initial investment and maintenance need not be great to produce an efficient, long-lived road.*



1934

Tarvia is made only by The Barrett Company, America's oldest and most-experienced manufacturer of coal-tar road-building materials. It is refined to rigid specifications exactly suited to the purpose for which it is to be used. It builds durable, easy-riding, skid-safe roads that are easy and inexpensive to maintain, and it qualifies for all types of emergency highway work authorized by the Federal Government.

#### THE BARRETT COMPANY

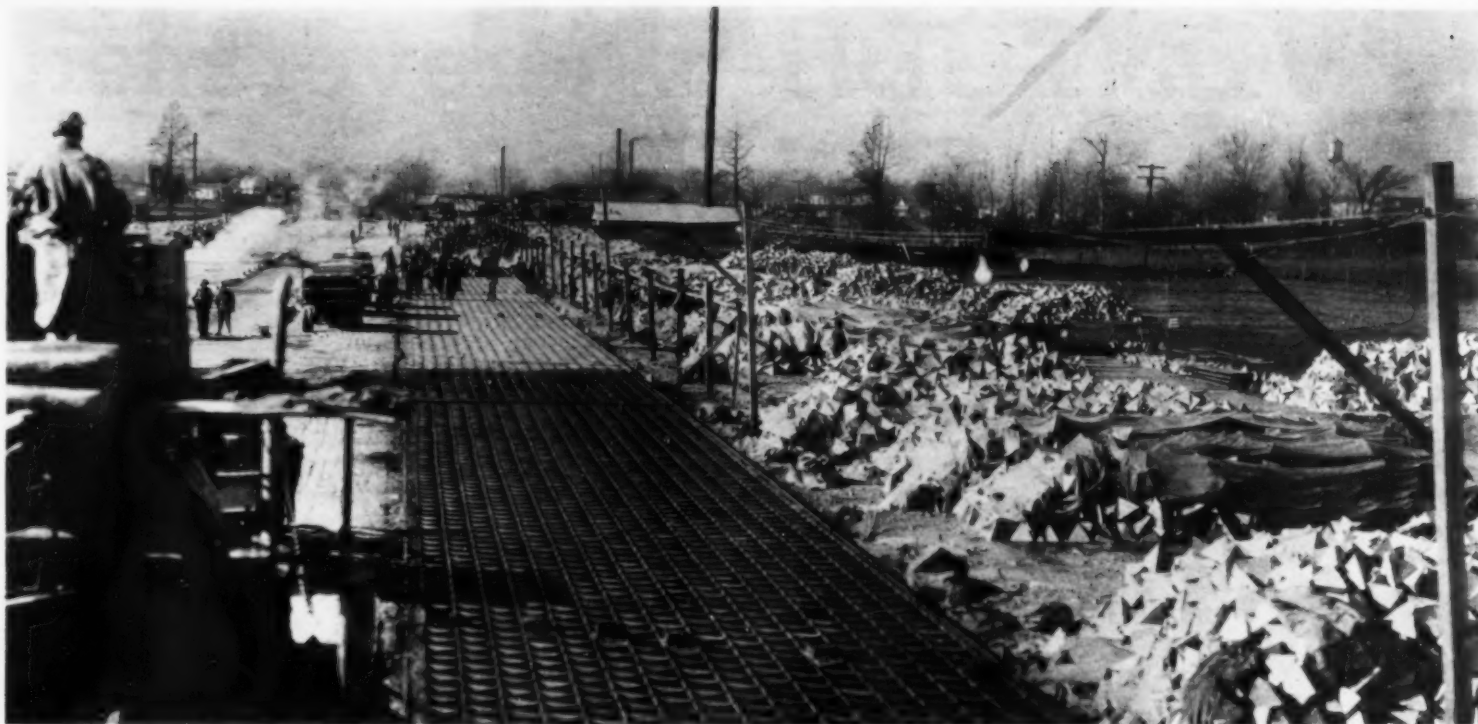
New York	Chicago	Philadelphia	Cleveland	Boston
St. Louis	Minneapolis	Lebanon	Toledo	Birmingham
Detroit	Baltimore	Columbus	Youngstown	Milwaukee
Buffalo	Providence	Syracuse	Hartford	Cincinnati
	Bethlehem	Rochester	Portland, Me.	

#### THE BARRETT COMPANY, LTD.

Montreal	Toronto	Winnipeg	Vancouver
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Fifty thousand concrete tetrahedrons produced daily, for use in Mississippi River flood control. Nested steel forms filled twice a day with 'Incor' Concrete from two paving mixers operating in tandem.

## 6¾ Million Concrete Pyramids to Keep Ol' Man River in His Place



Because Tetrahedrons stay put any way you drop them, flat-bed trucks are heavily loaded without sideboards. These 'Incor' units shipped within 48 hours after pouring concrete.



Loading barges, from which blocks are dumped at rates determined by barge speed, river current and depth. Low center of gravity assures stability.

*'Incor' Cement enables contractor to fill forms twice daily...48 hours from mixer to U.S.*

*Government barge, in winter weather*

Without fanfare of publicity, U. S. Army Engineers are driving ahead with Mississippi River flood-control operations. Of unusual interest is the use of concrete tetrahedrons, four-plane triangular-faced units, 12 inches in height. These units are dumped from barges at rates determined by laboratory experiment, based on barge speed, river current and water depth. Any face of a tetrahedron is the bottom, so whichever way they fall they stay put, low center of gravity assuring great stability. Space between blocks fills with silt, forming an integral bank-paving to keep Ol' Man River in his proper place.

### Highway Methods Used

Last November the U. S. District Engineer at Vicksburg took bids for 6,780,000 of these units, for revetting River slopes below Memphis. Specifications required contractor to cast and load on barges 50,000 units daily. Contract was awarded November 22nd to Simons-Mayrant Company, Charleston, S. C. Forms were designed to permit use of paving mixers and highway-construction methods.

Individual steel forms, nested at ground level, are filled with concrete from two mixers operating in tandem. When concrete hardens, forms are lifted, turned upside down, and the

blocks, released by hammer tap, are stored alongside casting bed for curing.

### Forms Used Twice Daily

By using 'Incor' 24-Hour Cement, the contractor fills his forms twice daily and units are delivered to Government barges in 48 hours or less. Average 48-hour strength of 81 cylinders of 'Incor' Concrete used on this job is 3166 pounds per square inch; specifications require 2000 pounds at time of delivery.

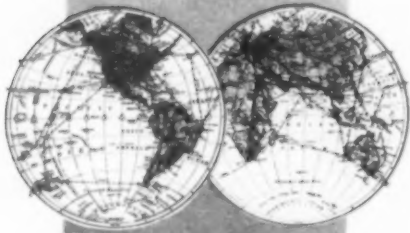
The 24-hour strength of 'Incor' Concrete enables the contractor to lower costs and increase efficiency. Take reinforced concrete buildings, for instance: With 'Incor', first-morning stripping of column forms and 24-hour removal of floor forms make possible immediate re-assembly. Erection speed doubled or trebled with one form set.

While concrete hardens, someone loses. 'Incor',\* a better Portland Cement, brings a new day in concrete construction, by making possible 60% to 80% reduction in concrete curing time . . . resulting in more favorable working conditions, steadier employment, reduced labor turnover, and lower costs all along the line. 'Incor' is made by the producers of Lone Star Cement, subsidiaries of International Cement Corporation, New York, and is sold by leading cement manufacturers.

\*Reg. U.S. Pat. Off.

## 'INCOR' 24-Hour Cement

# "VENTUBE"-wherever men pierce the face of the earth



Wherever men have tunneled in recent years on the face of the globe, du Pont Ventube has been used to carry fresh air to the working faces.

This portable, quickly assembled and efficient ventilating duct is being used in the Saar, in Russia, Australia, South Africa, Belgium and in the two Americas.

It has been tested thousands of feet below ground in the Pennsylvania mines, where heat, acids and fungous growth wage their war against all materials that men bring into their borings to help them with their work.

Du Pont chemists have been working steadily with it, have made it better than the original material that withstood so well the test of time. Mining engineers have built into it improvements that make it possible to install quicker.

Its advantages are many. Write to us for information on the use of "Ventube" in all mining and construction work.



E. I. DU PONT DE NEMOURS & CO., INC.

FAIRFIELD

CONNECTICUT

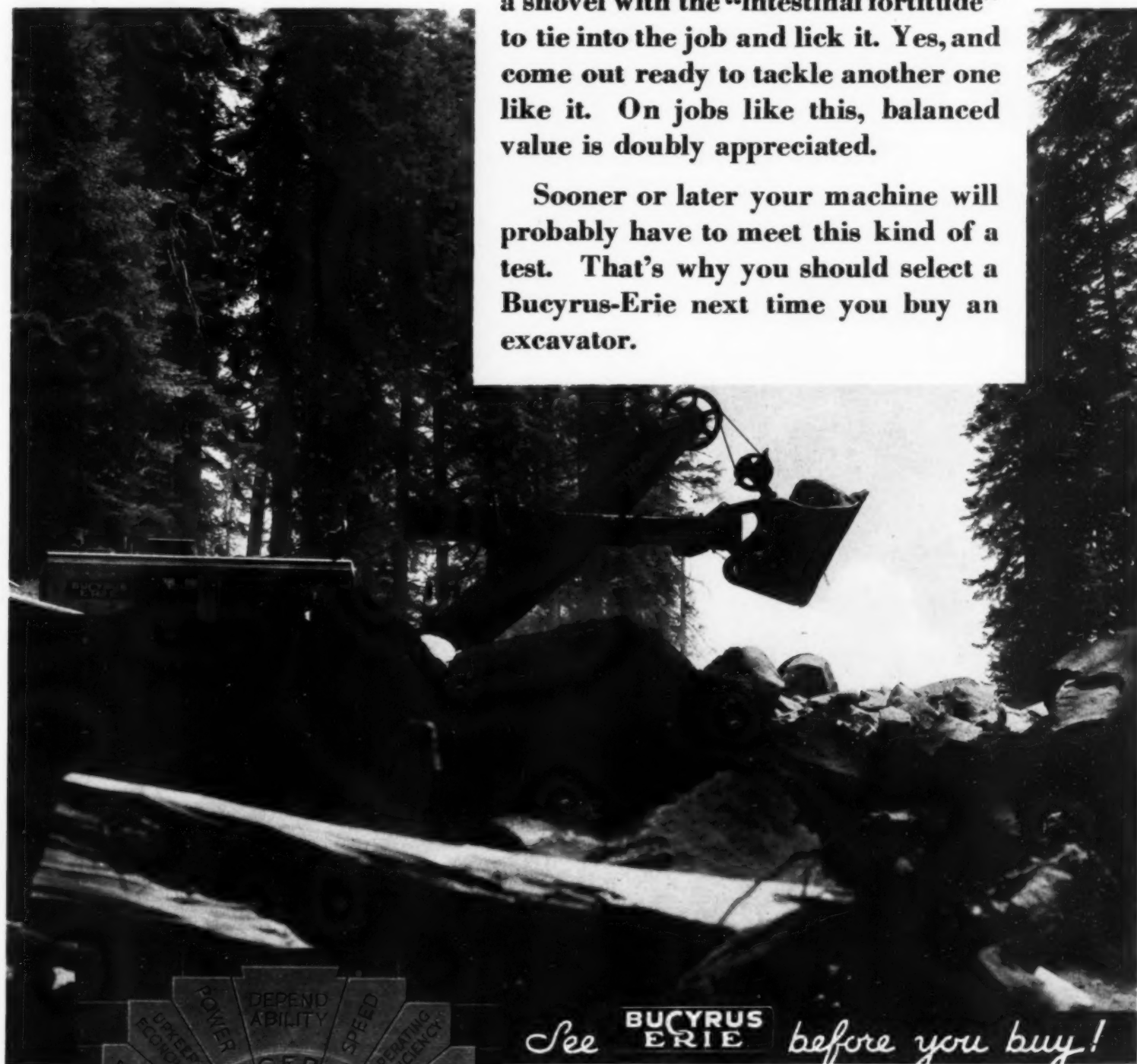




# Where Balanced Value is doubly appreciated

When you are up against digging like this you want a shovel as sturdy and staunch as they build them. It's no place for a weakling nor even for a good piece of machinery that has a weak spot here and there! It calls for a shovel with the "intestinal fortitude" to tie into the job and lick it. Yes, and come out ready to tackle another one like it. On jobs like this, balanced value is doubly appreciated.

Sooner or later your machine will probably have to meet this kind of a test. That's why you should select a Bucyrus-Erie next time you buy an excavator.



See **BUCYRUS-ERIE** before you buy!

BUCYRUS-ERIE CO., South Milwaukee, Wis.

# NATIONAL RECOVERY

**demands year-round concrete construction**

**"DO YOUR PART"**

THE steady employment of men—and more men—on concrete paving keeps things moving, not only on construction work, but in the industries which produce and transport the materials.

Proposed or winter-suspended projects can get under way at once if Calcium Chloride is used for concrete curing.

*Calcium Chloride in the mix accelerates the setting of the cement so that full-strength concrete is assured at low temperatures.*

Calcium Chloride provides full protection for cool-weather concreting, and even at freezing temperatures it shortens the curing period. It

thereby reduces the necessary requirements of further protection, such as heating of constituents and blanketing . . . so that cold-weather concreting is not excessively costly or troublesome.

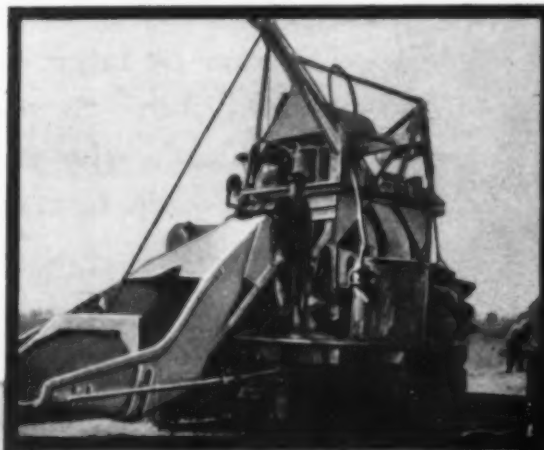
The better the cement the more necessary is the use of Calcium Chloride—for the finer cements are more affected by changes in temperature and are particularly reactive to Calcium Chloride.

• • •

*The use of Calcium Chloride in concrete is approved by the U. S. Bureau of Public Roads and the Portland Cement Association. Get the full Calcium Chloride story—write to any of the following members of the*

## METHOD OF USE IS SIMPLE:

(1) To a barrel one-third full of water, add one bag (100 lbs.) of flake Calcium Chloride. (2) Stir and then add enough water to half-fill the barrel (25 gallons), making sure that all the Calcium Chloride is in solution. (3) Add two quarts of this solution for each bag of cement in the mix—reducing mixing-water accordingly.



## CALCIUM CHLORIDE ASSOCIATION

THE COLUMBIA ALKALI CORPORATION  
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Midland, Michigan

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# CALCIUM CHLORIDE

**FOR EARLY-SPRING CURING AND HIGH-EARLY-STRENGTH CONCRETE**



Cut YOUR  
FUEL COSTS  
with ordinary  
furnace  
oil!



# TWO $1\frac{3}{4}$ yd. SHOVELS for A. TEICHERT & SONS, INC., Sacramento, Cal. with NORTHWEST OIL ENGINES

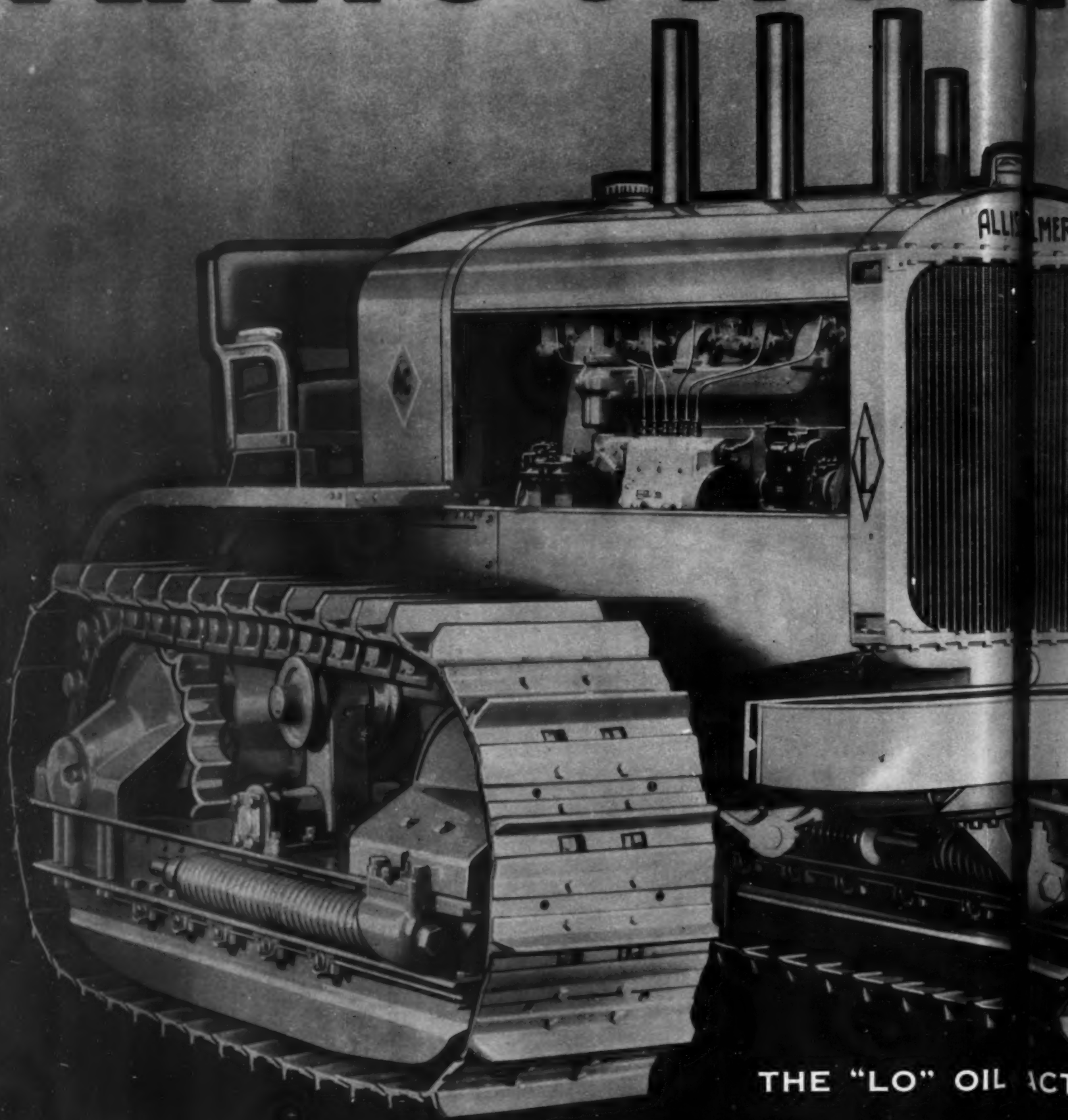
A. Teichert & Sons, Inc., specify Northwest — two of them! Not only a repeat order for a Northwest shovel, but a repeat order for a Northwest Oil Engine, with all its advantages of fuel economy, slow-speed, hanging-on power and simplicity.

The Northwest Oil Engine will bring A. Teichert & Sons Inc., the economy of low priced fuels without high pressures and without delicate injectors or metering devices. It means gasoline engine simplicity and reliability.

You, too, can figure these advantages on your next job. Find out about the oil engine — let us tell you how it will save for you.

**NORTHWEST ENGINEERING CO.**  
The world's largest exclusive builders of gasoline, oil burning and electric powered shovels, cranes and draglines  
1728 Steger Bldg. 28 E. Jackson Blvd. Chicago, Ill., U. S. A.

# ANNOUNCING



THE "LO" OIL ACT

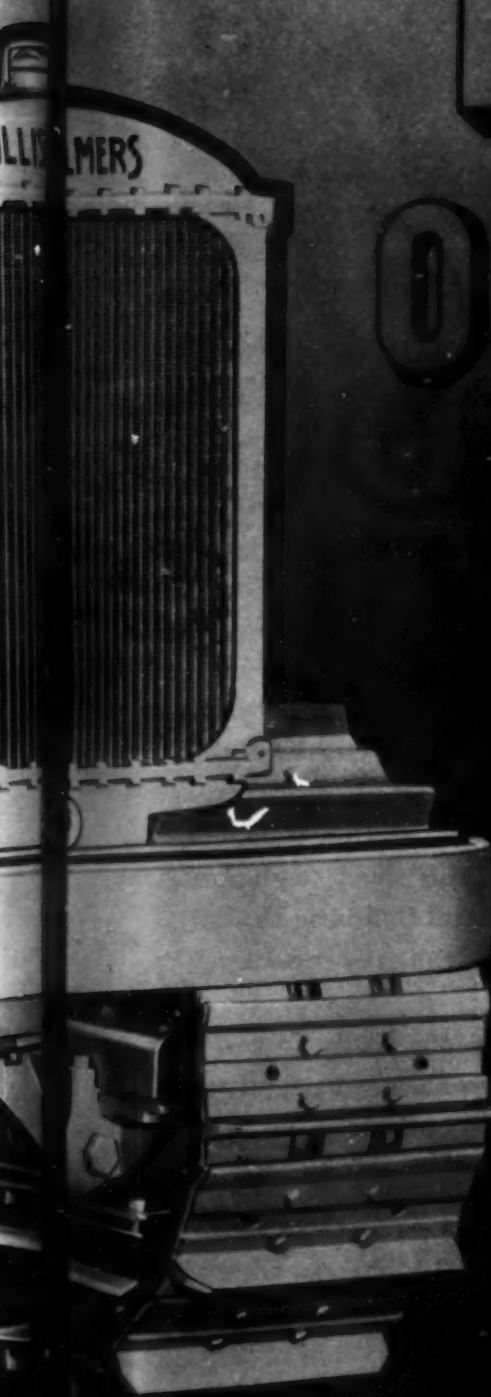
POWER CONTROLLED GRADERS  
HAND CONTROLLED GRADERS  
SPEED PATROL GRADERS  
TRACK-TYPE TRACTORS  
ELEVATING GRADERS

# ALLIS-CHALMERS

TRACTOR DIVISION MILWAUKEE



# Introducing the New models "KO" AND "LO" OIL TRACTORS



**T**HE New Allis-Chalmers Oil Tractors are equipped with a new type of oil engine which operates on Diesel fuel. These engines introduce an entirely new principle in tractor engine design.

We use a Bosch Diesel fuel pump to inject the cold charge with cold air and ignite it with a spark. We do not depend on compression for ignition, but use the time-tried magneto.

The low pressures and orderly burning of the fuel in the A-C oil engines assure a smooth running engine with unexcelled lugging ability and ample power. Fuel consumption is low at all loads.

Two models are now available—the model "KO", developing 48 drawbar horsepower and weighing approximately 11,200 pounds—and the model "LO", developing 76 drawbar horsepower and weighing approximately 23,000 pounds.

OIL TRACTOR

Write for further information.

**ALLIS-CHALMERS**  
MILWAUKEE, U. S. A.

POWER UNITS ....  
MODELS 40, 50, 60, 90, H. P.  
WHEEL TYPE TRACTORS  
TRACK TYPE WAGONS  
WAGON TRACKS

# Wherever earth must be held back...use *ARMCO METAL CRIBWALLS*

CALL



IN AN ARMCO ENGINEER

Whether you are designing retaining walls for highways, railways, streets or stream banks,

you can be sure of speedier installation and positive earth retention with Armco Metal Cribbing.

Consider just a few of its many applications: grade separations, bridge abutments, wing walls, bank protection, and for restricted right of way. There are many more.

These uses are illustrated in a new 24-page booklet that will interest you. Here you will see the strength, light weight, rapid installation, economy and other advantages of this efficient retaining wall. If you need to design a wall, we have a Metal Cribbing Design Manual that gives you the necessary information.

An Armco engineer is ready to assist you. But whether or not you send for him, write for a copy of our illustrated booklet.

**ARMCO CULVERT MANUFACTURERS ASSOCIATION • Middletown, Ohio**



Stopping a small slide with Armco Metal Cribbing along a state highway in Elk County, Pennsylvania.



Inset at left shows how the header and stretcher units are firmly locked together with bolts at all joints.



☐ Please send me your latest illustrated booklet on ARMCO METAL CRIBBING.

☐ I am interested in a wall .....ft. long and .....ft. high.

Name .....

Title .....

Address .....

I am ☐ an Engineer ☐ Contractor ☐ Official

☐ Student CM-3





Bound to the construction field from coast to coast by many ties resulting from Quality Engineering, "AMERICAN" Hoisting Equipment has carved an important place for itself that becomes more firmly entrenched as each job ahead is reached and completed.

AMERICAN HOIST & DERRICK CO.  
SAINT PAUL, MINNESOTA

# AMERICAN



# GOPHER

SHOVELS—CRANES—DRAGLINES  
LOCOMOTIVE CRANES—REVOLVERS

HOISTS — DERRICKS — PILE DRIVERS  
BLOCKS—SHEAVES

# LIMA brings new economies to dragline users . . . .

Is there any wonder that owners of LIMA draglines are enthusiastic about their machines? LIMA advantages are giving them new low figures on operating costs.

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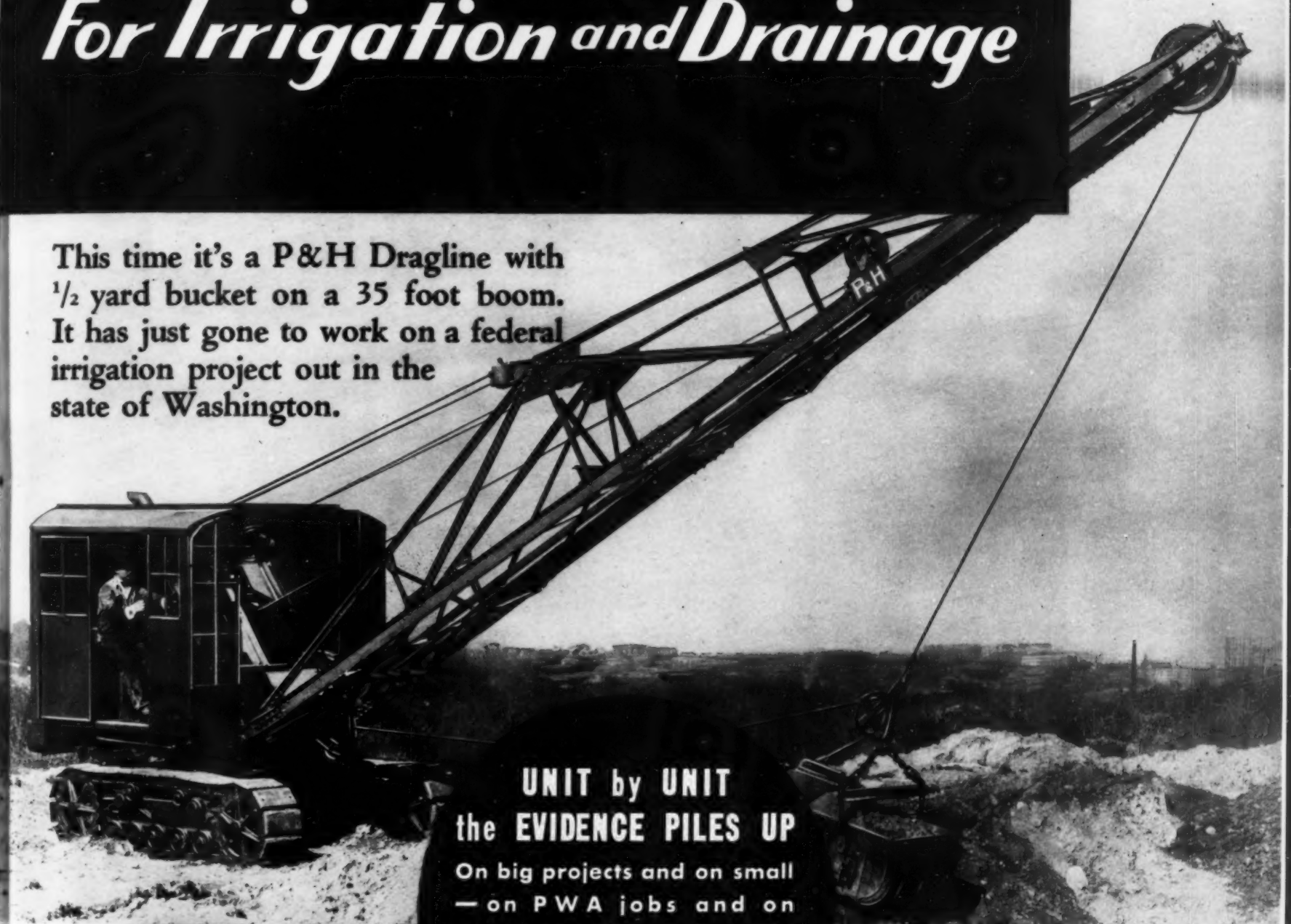


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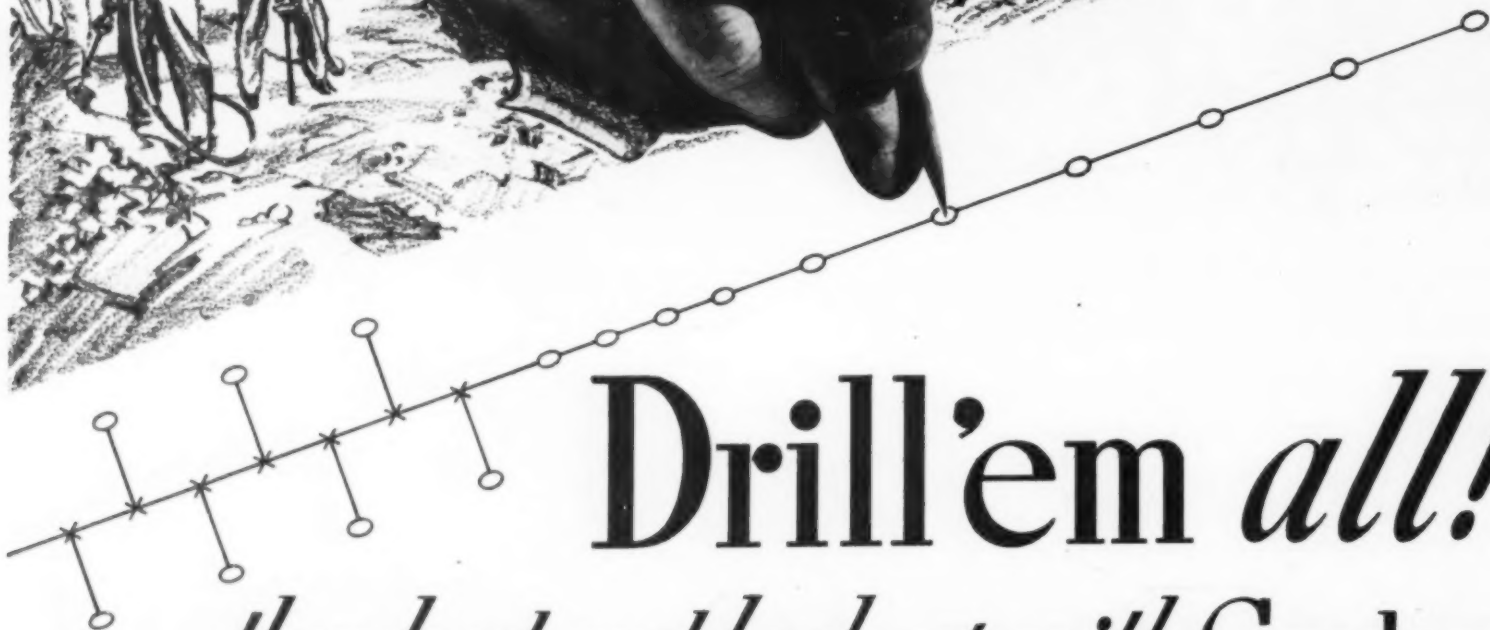
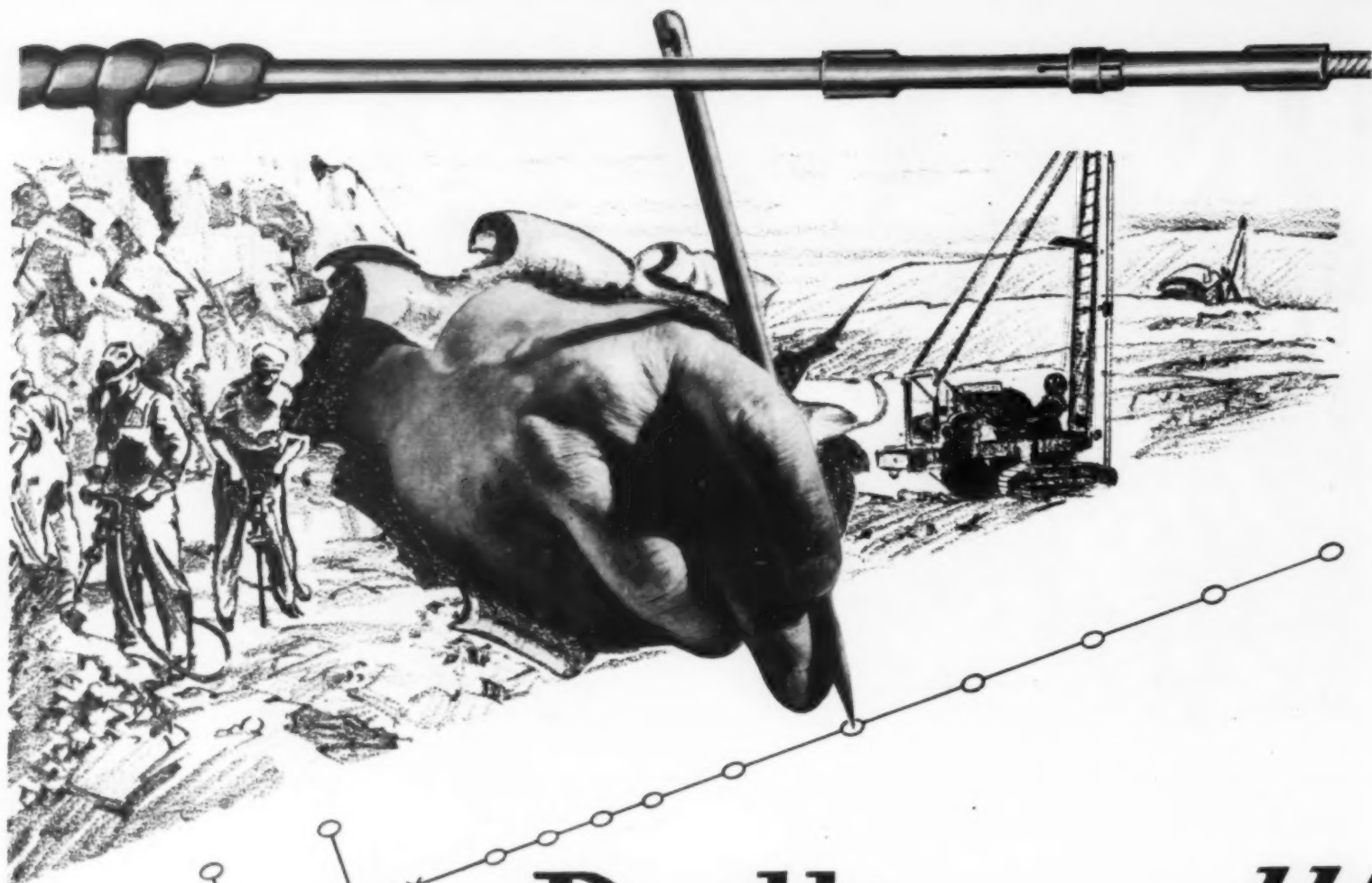
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## *then load and hook-up with Cordeau*

Jackhammer, wagon drill, and well drill holes can be hooked up to go in one giant blast — with Cordeau-Bickford Detonating Fuse. Instead of drilling, moving, blasting, clearing, moving back, drilling—and so on over and over again, why not drill 'em all, load and hook up with Cordeau, *and fire them all at one time?*

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*This is the Cordeau Book. It describes a new technique in blasting that may mean more economies, more profit — for you. Free to executives.*



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Ensign-Bickford Safety Fuse is available in a number of standardized brands, each carefully made for a particular set of conditions. The use of Safety Fuse simplifies blasting technique.

Also—there are a number of Ensign-Bickford lighters, inexpensive—and positive in action.

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## "NONE APPROACHED IT"

The following telegram was sent by Morrison-Knudsen Co. to a prospective purchaser of a Link-Belt shovel, regarding machine illustrated herewith:

"With reference to our experience with the K-55 Link-Belt shovel on rock excavation at Lyle, Wash. Did wonderful work. Equipped with a 2.3 cu. yd. dipper. As an idea of its capacity, it averaged 102 cu. yds. per digging hour for first thirty days on this job, with nearly all this material loaded into trucks. Had four other shovels on job, but none approached it in output, and they were in easier digging."

R. E. Herrick, Morrison-Knudsen Co., Boise, Idaho.

Let a Link-Belt carry the profit burden on your next job. From  $\frac{3}{4}$  to  $2\frac{1}{2}$  yds. capacity, heavy duty built. Gasoline or Diesel engine, or electric motor drive.

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300 West Pershing Road, Chicago

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# LINK-BELT

SHOVEL-  
CRANE-  
DRAGLINE



Atlas White traffic marker on Nicollet Avenue, Minneapolis. Installation by City of Minneapolis.  
Fred Paul, City Engineer. J. C. Vincent, Traffic Engineer.

## White—UNDER HEAVY TRAFFIC

As Fifth Avenue is to New York, as State Street is to Chicago, so is Nicollet Avenue to Minneapolis. Every day the traffic roars along that busy, bustling central thoroughfare—pleasure cars, business cars, busses, trucks. A traffic marker on that street meets heavy duty. No temporary marker can stand the gaff. White concrete markers do.

Down the center of Nicollet Avenue runs an Atlas White traffic marker, 2100 lineal feet of it, *built into* the pavement. Anchored in solid concrete, made of solid concrete itself, that traffic marker will last as long as the pavement lasts. But will it stay white? The best answer to that is the marker itself. It has been down now a little more than six months—a good start on the years of service it will give. And it is as clean and clear and sharp today as it was six months ago, and as it will be six times six months from now.



...clear and sharp, even from a bird's eye view.

White concrete traffic markers *start white and stay white.*

This marker cost more to install than a temporary marker would have. But that original cost is the *last* cost. No replacement charges on this marker. In not very many more months' time it will actually have paid for itself in the saving in maintenance expenses which temporary markers would have required. Because they stay everlastingly white, Atlas White traffic markers *save* more than they cost.

These markers can either be built on the job, or precast. They can be installed any time—winter or summer. They save money, they guide traffic efficiently, they are *always* white. Write for detailed information to Universal Atlas Cement Co. (Subsidiary of United States Steel Corporation), 208 South LaSalle Street, Chicago.

## ATLAS WHITE TRAFFIC MARKERS

Made with Atlas White Portland Cement—Plain or Waterproofed



# Construction Methods

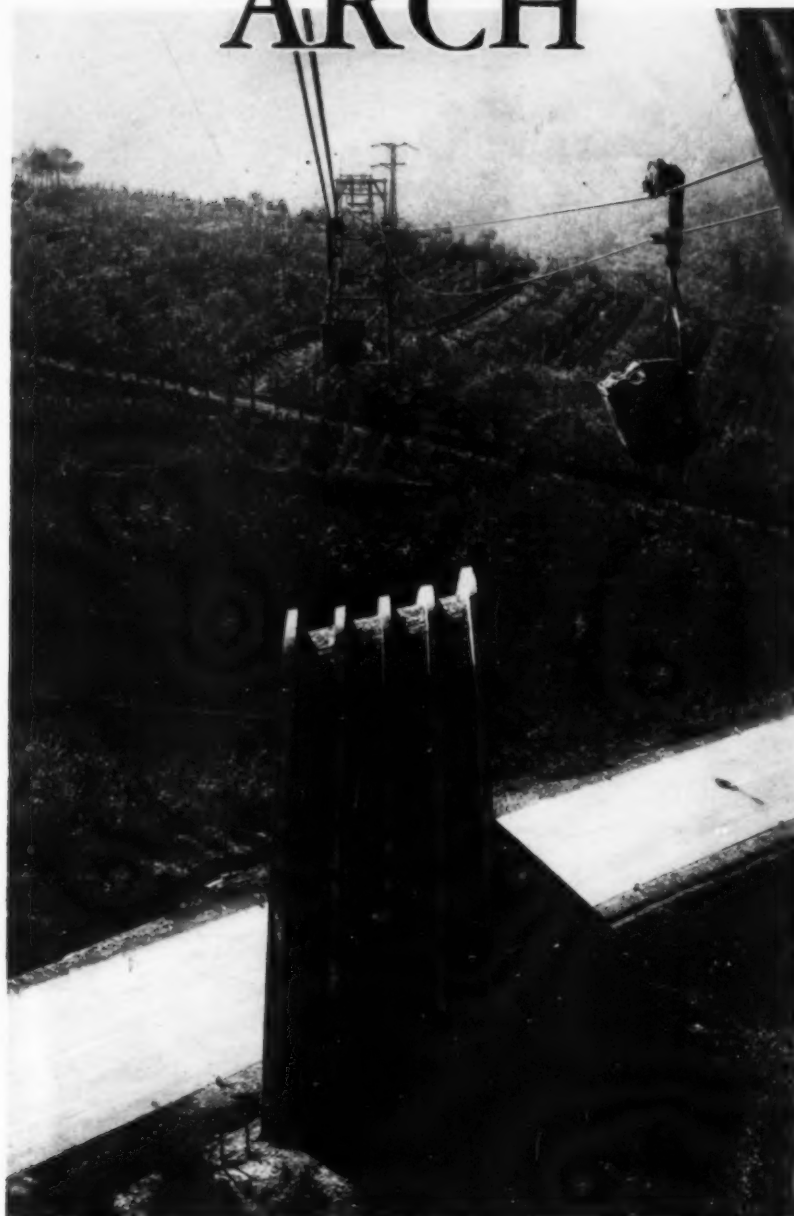


Established 1919—McGraw-Hill Publishing Company, Inc.

ROBERT K. TOMLIN, Editor

Volume 16—Number 3—New York, March, 1934

## *Motor Roadway Under Aerial Tramway* *Protected by* **CONCRETE ARCH**



CONCRETE ARCH protects motor route from material that might fall from buckets of aerial tramway serving cement plant.



RIBS serve to reinforce parabolic arch of reinforced concrete against impact stress of falling material.

A NOVEL STRUCTURE, in the form of a reinforced-concrete, ribbed arch, has been built in Italy to protect a motor parkway extending from Florence to the sea from the hazard of material falling from the buckets of an aerial tramway which crosses the route at an angle of 49 deg. near Serravalle. As described in *La Technique des Travaux*, the protective cover over the road is parabolic in shape and its design is based upon the results of tests made upon a model built to a scale one-tenth the size of the actual structure.

The aerial tramway crossing the road delivers marl to a cement manufacturing plant. It is equipped with two cables, spaced about 6½ ft. apart, one

for loaded and the other for empty buckets. The pieces of marl thus transported weight from 22 to 88 lb.; the weight of an empty bucket is 220 lb. and of a bucket fully loaded, 660 lb. The concrete arch is designed to withstand the impact of an 88-lb. block of marl falling through a distance of 65½ ft. from the overhead tramway. As illustrated in one of the photographs, the arch is reinforced by a series of ribs, which form steeply sloping chutes through which material, accidentally falling from the tramway, would be diverted from the roadway and passing motor vehicles.

For the company which operates the motor parkway the protective arch was designed by E. Bianchini, engineer.

# This Month's "NEWS REEL"



NATIONAL LABOR BOARD convenes in Washington. (Left to right, seated) LOUIS E. KIRSTEIN, Boston; SENATOR ROBERT F. WAGNER, of New York, chairman; DR. LEO WOLMAN, New York. (Standing) WILLIAM GREEN, president, American Federation of Labor; GEORGE BERRY, Pressman's Home, Tenn.; PIERRE S. DuPONT, Wilmington, Del.; FATHER FRANCIS J. HAAS, Washington.



FEDERAL BUILDING PROGRAM in Washington, D. C. brings into reality large part of general plan for triangle bounded by Pennsylvania and Constitution Aves. and 15th St., N. W. Buildings in use or nearing completion in this area are: (1) Department of Commerce, which also houses NRA; (2) Post Office Department; (3) Department of Labor; (4) Interstate Commerce Commission; (5) Bureau of Internal Revenue; (6) Department of Justice; (7) Archives. Those constructed under present program are (2), (3), (4), (6) and (7). Pile foundations for connected buildings, (2), (3) and (4), are described in this issue.



TIDES RAISE AND LOWER 600-ton draw span of Quincy-Weymouth bridge, moved upstream 400 ft. and installed in temporary pile and timber structure by Blakeslee-Rollins Corp., of Boston, for Massachusetts Department of Public Works, to carry traffic during construction of new bridge at old site.

UNITED STATES COURT HOUSE, New York City, has 10,500-ton steel skeleton, rising 570 ft. above street, erected by McClintic-Marshall Corp. for James Stewart & Co., Inc., general contractor. Building incorporates 38 floors with total area of 642,000 sq. ft.







**SITE OF GRAND COULEE DAM**, 700,000-hp. hydro-electric project being constructed by U.S. Bureau of Reclamation on Columbia River in central Washington, is cleared of 2,000,000 cu. yd. of overburden. Plans call for early advertising of bids for main contract and for starting actual construction about May. Roland Construction Co., of Seattle, subcontractor for 200,000 yd. of overburden excavation, operates two Caterpillar 75-hp. diesel tractors with LeTourneau 12-yd. scrapers hauling 9 yd. of sand per load.

**COFFERDAM FOR FIRST HALF** of Norris Dam (right) extends to mid-stream of Clinch River, Tenn. Designed to pass flood of 50,000 sec.-ft., cofferdam is of filled-crib construction sheeted on both faces to avoid loss of fill in case of overtopping. Shoulder excavated on slope above dam abutment will carry head towers of two 18-ton traveling cableways with 1,900-ft. spans. To speed start of work, Tennessee Valley Authority is prosecuting construction by force account employing total of more than 1,400 men on four 5½-hr. shifts per day.

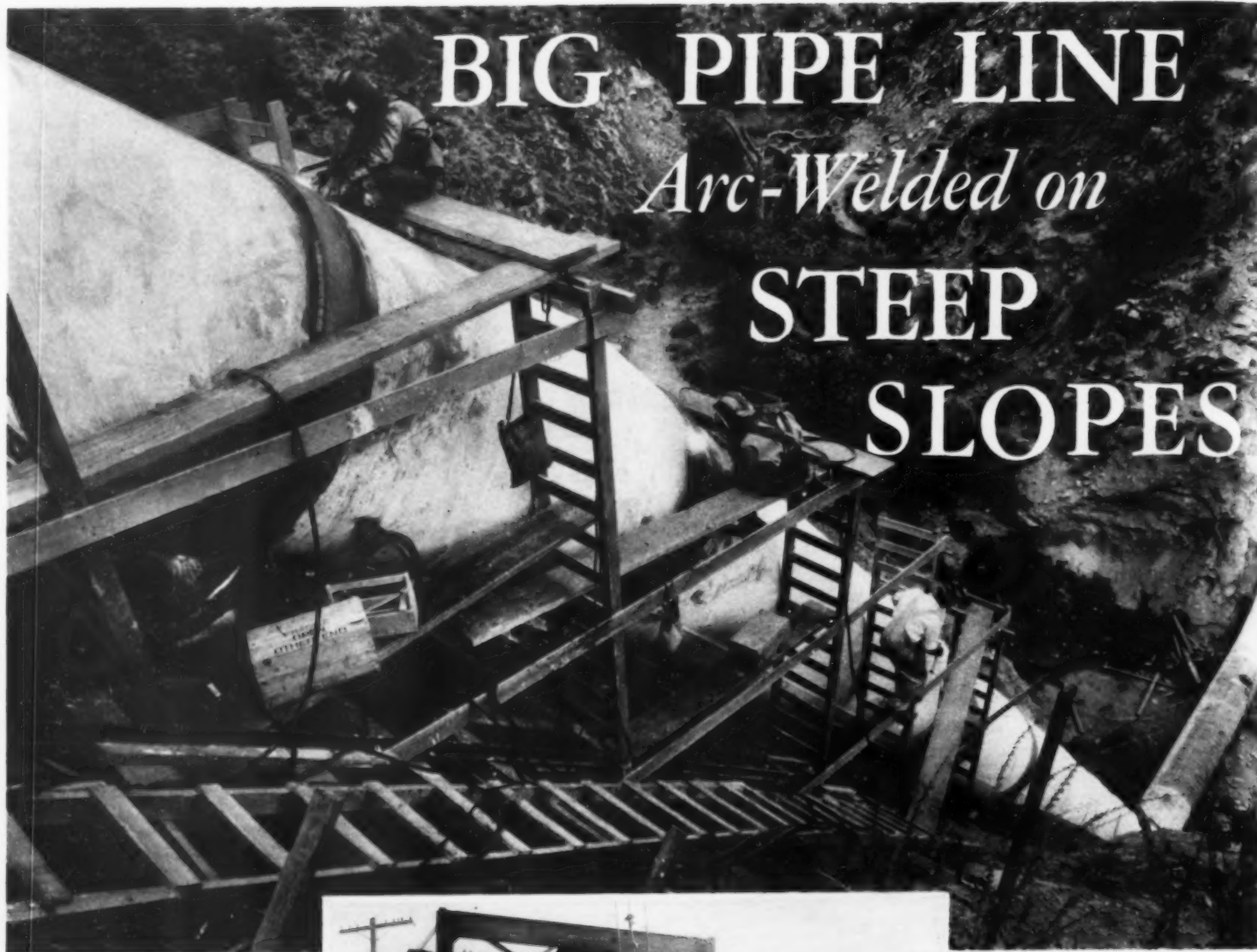


**BROOKPARK BRIDGE** across Rocky River valley, Cleveland, 2,500 ft. long and about 110 ft. high, carries 40-ft. roadway and two 5-ft. sidewalks. Pier and spandrel columns were constructed with steel forms re-used sixteen times, as noted in **CONSTRUCTION METHODS**, Sept., 1933, p. 25. Bridge handrail has rubber expansion joints of new type, illustrated in "Getting Down to Details" in this issue. The Highway Construction Co., of Cleveland, was general contractor for structure, which cost about \$450,000.

# BIG PIPE LINE

## *Arc-Welded on*

# STEEP SLOPES



SPECIAL SCAFFOLDING of planks and ladders aids arc-welding of pipe joints on steep inclines.

**W**HAT IS CLAIMED to be one of the largest electrically welded pipe lines in the West, with diameters ranging from 80 to 94 in. and a length of  $4\frac{1}{2}$  mi., is being built to connect the storage and balancing reservoir formed by Bouquet Canyon dam with San Francisquito power house No. 1, on the line of the Owens Valley aqueduct, about 50 mi. north of Los Angeles. The new pipe line will aid the Los Angeles Bureau of Water Works and Supply in regulating aqueduct flow for both water supply and power purposes.

The terrain crossed by the pipe line presented construction difficulties in the form of canyons with exceptionally steep side slopes on which the heavy pipe sections had to be laid and joined by welding. At one dip in the line the pipe will operate under a head of water of 820 ft., producing a pressure of about 400 lb. per square inch and requiring a  $1\frac{1}{16}$ -in. thickness of metal for the 80-in. diameter pipe at this



"STRADDLE BUG" (left), on flange-wheel mounting, handles 12-ton pipe section with pair of air hoists.

point. Two other pipe sizes are used in the line: 86-in., with a wall thickness of 1 in., and 94-in., with a thickness of  $\frac{3}{8}$  in.

The pipe is fabricated by the Western Pipe & Steel Co. from three sections of steel plate requiring three welds in addition to a lip welded to the ends. Each section, weighing about 12 tons, is hauled by truck to a sand-blasting and painting plant operated by the Bureau of Water Works and Supply. After being cleaned and painted the pipe sections are delivered by motor truck to the head of the canyon above the power house, picked up by Link-Belt crawler cranes and transferred to a wheel-mounted steel-frame carrier or "straddle bug" in which they are lowered by an electric hoist down the precipitous slopes followed by the line leading to the power house. The "straddle bug" is equipped with two air-operated hoists for raising or lowering the pipe sections and lining them up as a preliminary to welding.



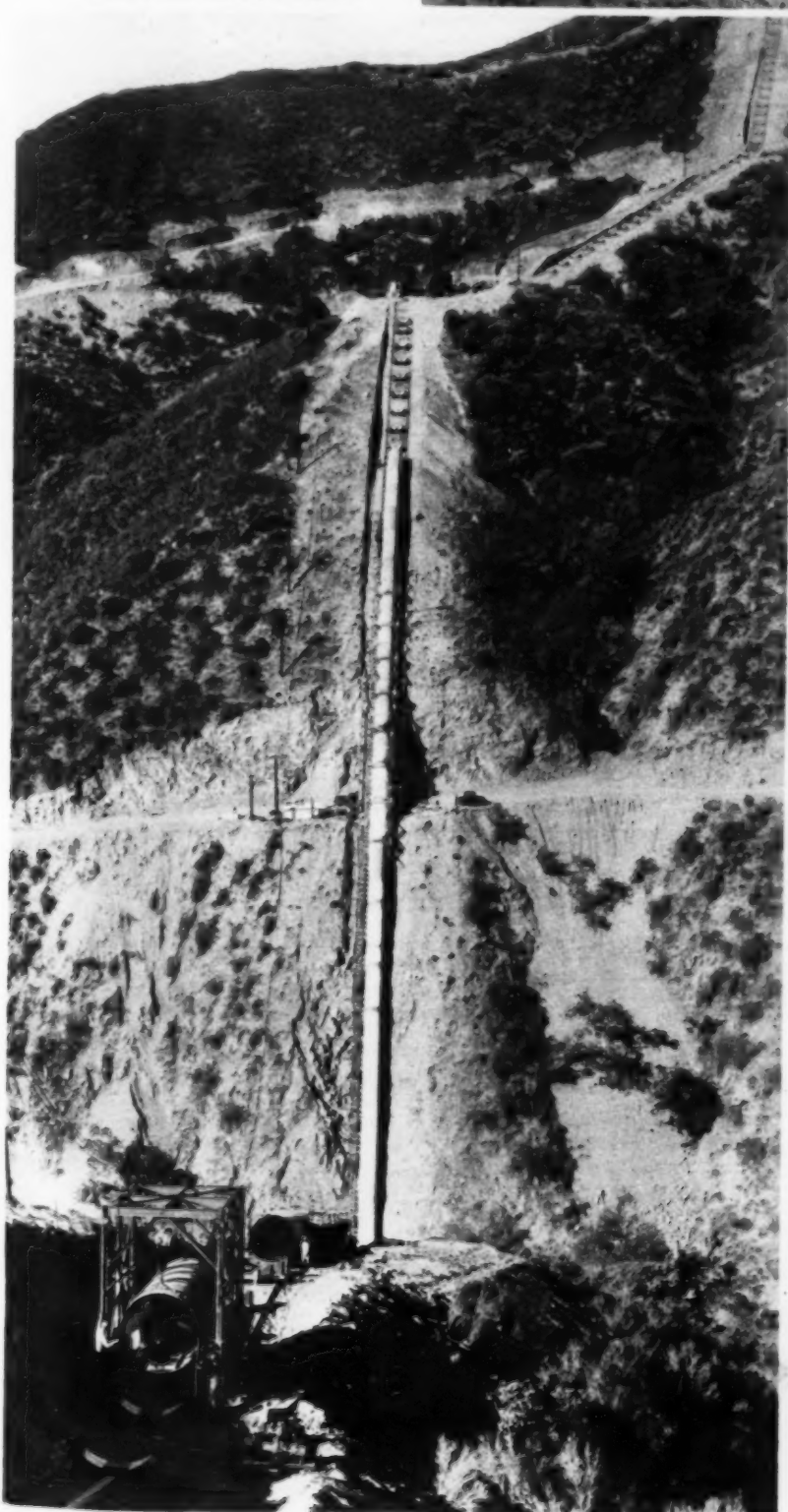
Ten Westinghouse arc-welding machines were purchased for this job, which is being carried forward by three shifts of welders, each working 8 hr. per day.

For each inside weld two or three beads are laid in the bottom of the V with 5/32-in. rod. Then 3/16-in. electrodes are used for building up the V within 1/4 in. of being flush. For finishing the bead either 3/16- or 7/32-in. electrodes are used, the operator starting the weld at the bottom and working upward. Welding of the inside butt-weld is being done at an average speed of a little less than 1 ft. per hour. A

**CANYON CROSSING (below)** where pipe will be under 820-ft. head. In foreground, "straddle bug" is placing 12-ton pipe section on concrete saddle supports to join section of line already complete.



**WELDED LIP** on end of pipe length facilitates joining of sections preparatory to making field welds.



**INSIDE WELD** being made on 86-in. diameter pipe on steep canyon side. On each joint 32 man-hours are required for outside and 24 man-hours for inside weld.

butt-strap is used on the outside weld.

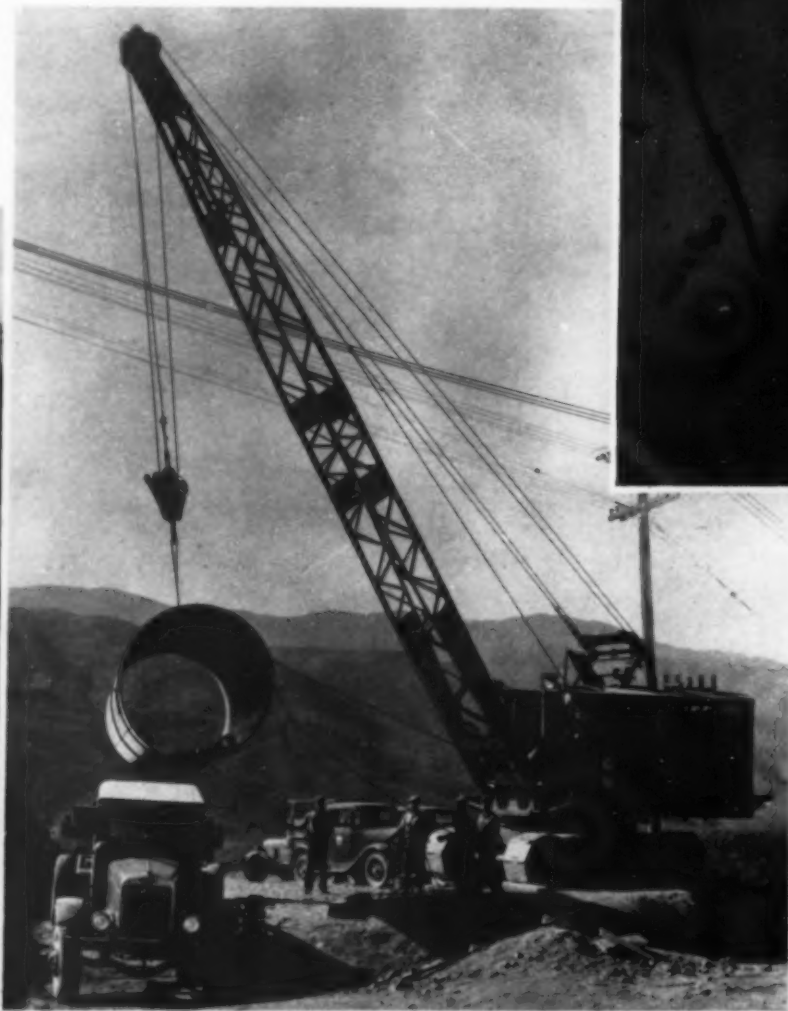
In both fabrication of the pipe and in the field welding the shielded-arc process is used with Fleetweld electrodes manufactured by the Lincoln Electric Co. An idea of the size of this pipe is indicated by the fact that it takes 450 lb. of electrode to weld each joint on the job. Thirty-two man-hours are required to weld the outside of each joint and 24 man-hours for the inside. Welding operators employed on this project were required to pass very rigid

tests before being hired. On the steep slopes followed by portions of the  $4\frac{1}{2}$ -mi. line the welding is done from special scaffolds, as illustrated.

Methods of pipe line construction similar to those illustrated herewith were employed on a slightly smaller penstock line (72 to 84 in. in diameter) serving San Francisquito power house No. 2, described in *Construction Methods* for February, 1933, pp. 16-18.

**CRAWLER CRANE** (below) unloads 12-ton sections of pipe delivered by motor truck. Before being placed in line pipe is sand-blasted and painted.

**BIG DIP** (below). Line descends 820 ft. from top of hill, where crane is placing section of pipe in "straddle bug" carrier for lowering down canyon side.



**OUTSIDE WELD** being completed at joint in 86-in. diameter pipe line on steep slope.

**ELECTRIC WELDING MACHINES** (below) along line of pipe. Note type of ladder and plank scaffold, at right, to enable operators to work on top section of pipe. Slope of pipe line in background is 76 per cent.





# Three Communities Re-Employ Labor on PWA and CWA PROJECTS

**A** THOUGHT-PROVOKING CONTRAST in methods of financing construction in the present readjustment is presented by a PWA project and two CWA projects in Pennsylvania, recently visited by a *Construction Methods* representative. Hand labor methods were adopted by necessity on the CWA projects and by choice on the PWA project to give work to as many local unemployed men as possible. All the projects were major undertakings on which a large number of workmen could be employed effectively. Aside from questions as to the wisdom of financing major construction with CWA funds and of utilizing hand labor on PWA work, the projects represented well-directed attempts to relieve serious local unemployment by concentrating large numbers of workmen on projects of lasting public benefit.

Capable labor management by experienced superintendents and skilled engineering supervision by a firm of consultants were accomplishing results of value on all three projects. In each of the communities involved, the large local project served to take up completely the slack in employment. Speedy organization of the job, rapid hiring of the unemployed men, and efficient utilization of the available labor distinguished each of the projects. In every case, actual construction followed immediately upon approval of the application.

**Project Classifications** — All three projects were of a major engineering character. Under normal conditions, the two CWA projects probably would be built by regular construction organizations under contract. For this reason, they may be said to conflict with the announced intention of CWA not to invade the province of PWA. Actually, the projects represented compromises



ON DANVILLE RESERVOIR PROJECT. (Left to right) W. K. WARD, construction superintendent; FARLEY GANNETT, president of Gannett, Seelye & Fleming Engineers, Inc.; T. B. EVANS, deputy Civil Works administrator; and J. D. CARPENTER, project engineer.

between this policy and the need of quickly putting large numbers of local unemployed to work. On both the CWA projects the work consisted principally of dry excavation and grading. Additional work remained to be done on both projects after Feb. 15, when the original CWA term of employment expired.

At all three projects men were furnished by the local office of the National Reemployment Service. Work was carried on six days a week in two shifts, from 7 a.m. to 12 m. and from 12 m. to 5 p.m. This division of the day's schedule utilized every bit of daylight in the short winter days, eliminated the chilling lunch period, and enabled inexperienced men to work steadily for the 5-hr. shift with less exhaustion. Common labor, — the category which included practically all the workmen, — received 50c. an hour. A few skilled workers were paid \$1.00 to \$1.20 an

hour, and foremen, selected from the ranks of the unemployed, received 60c. and 75c.

An outstanding example of a single project which absorbed many unemployed was the improvement of the flood channel of the Codorus River in York County, below the city of York, to reduce the crest of any flow approaching that of last summer's destructive flood. More than 3,200 men were receiving wages on this project. York County, with a total registration of more than 9,000 unemployed, could not possibly utilize all this labor effectively on minor projects outside the province of ordinary contract construction. In this situation the proposed river improvement and flood control program offered a unique opportunity to put a large number of men to work quickly on useful construction.

At Danville, Pa., in a smaller community, a similar unemployment situ-

ation existed. To put a force of 400 men at useful work the town applied for funds to start a water-supply reservoir which had long been recognized as an economical and necessary addition to the borough's water-supply system. Both at Danville and at York, the community contributed a good share toward the cost of the project.

Shippensburg, which built an 11-mi. water-supply line with the aid of a PWA grant, was the only one of the three communities which re-employed its local labor in complete accordance with the stated policies of the federal works administrations. The borough financed the project through the sale of bonds on the open market and with the aid of the PWA grant. To increase the number of local unemployed who could be given work on the project, the pipe line was constructed with hand-labor methods. This procedure added to the cost, but the PWA grant more than covered the difference. Although the hand-labor policy may be called short-sighted in the broadest business sense, the borough was pre-eminently within its rights in spending the money to relieve unemployment in this way.

Each of the three communities retained a firm of consulting engineers, Gannett, Seelye & Fleming Engineers, Inc., of Harrisburg, Pa., to supervise construction. This firm also executed the engineering designs for the projects at York and Shippensburg. Shippensburg furthermore awarded the management of construction (to be performed by day labor) to the same firm on a fixed-fee basis.

## SHIPPENSBURG WATER LINE

To finance the construction of 11-mi. of 12-in. cast-iron water main from a new source on North Mountain to Shippensburg, the borough obtained PWA approval for a grant of \$35,000



WATER-SUPPLY MAIN of impact-resistant cast-iron pipe is laid in trench dug and backfilled by hand labor on Shippensburg's 11-mi. project tapping new source of supply.



HAND-LABOR CREWS average 500 ft. of line dug, laid, backfilled and tested for each calendar working day on project financed in part by PWA grant.



POWER EQUIPMENT AND HAND LABOR cooperate in building rolled-earth embankment for distributing reservoir.

and sold to a banking house at a premium \$100,000 worth of 4 per cent bonds. Approval of the Public Works Administration was given on Oct. 27, and actual construction started on Oct. 30, 1933. Each of two shifts employed 120 men, making a total of 240 on the project.

A trench 2 ft. wide and 4½ ft. deep was excavated by hand for the pipe, which was required to have at least 3 ft. of cover. Practically all of the trench excavation in the first 4 mi. consisted of clay, sand, gravel or shale which could be removed by hand. A 310-cu. ft. compressor was used on this section to drive air tools and drills needed in breaking boulders or hard shale and trimming the bottom of the trench. On the next 4 mi., so much limestone rock was encountered that the constructors added one 250-cu.ft. and one 110-cu.ft. compressor—all Ingersoll-Rand machines. The line required about 2,000 tons of 12-in. cast-iron bell-and-spigot pipe, in 18-ft. lengths, with a ⅛-in. cement lining covered by a coat of bitumen. This pipe, manufactured by the Super-deLavaud process of the United States Pipe & Foundry Co., had the high impact resistance which made it particularly serviceable in the hands of inexperienced workmen.

Costs of digging trench and backfilling by hand were considerably higher than machine costs would have been for the same operations. Job-payroll labor costs (exclusive of explosives, equipment rental, compensation insurance and other incidentals) for the first 8 mi. of line were about as follows: digging, 42,000 lin. ft., 50c. per linear foot; backfilling, 36,000 lin. ft., 15c. per linear foot; and pipe laying, 38,000 lin. ft., 10c. per linear foot,—a total labor cost of \$0.75 per linear foot.

Most of the men employed on this project previously had worked in outdoor occupations, and they were prepared to produce effectively on hand-labor construction almost from the start. Actual average progress during the first 72 calendar working days, eliminating Sundays and legal holidays, but including 4 days lost because of bad weather, was 500 lin. ft. of line completed, tested and backfilled each working day. Bryan Eastman was resident superintendent in charge of construction and Paul Miller was resident

tion, making a total of 480,000 yd. Only the dry excavation was included in the CWA schedule. The completed channel for this section is to be 220 ft. wide and 10 ft. deep, with a bottom which slopes to a low water channel 60 ft. wide and 13½ ft. below the full water level. Below Mill Creek, which

H. Channel Anderson, a resident of York County, who has had extensive experience on large construction projects, was the superintendent in charge of the work. As his principal aides, the superintendent had three assistant superintendents, who were unemployed York County residents. All these men



SHOVEL GANGS spread dumped loads of earth and shale to be compacted by power roller.

engineer in direct charge of pipe laying.

#### YORK COUNTY FLOOD CONTROL

A flood of 35,000 sec.-ft. in the Codorus River last August raised the stream 8 ft. above the floor of the Market St. bridge in York and caused damage conservatively estimated to exceed \$4,000,000. Floods of approximately equal volume occurred in 1884 and 1817. Soon after the 1933 flood, an engineering investigation was begun by Gannett, Seelye & Fleming Engineers, Inc. The engineers' report contemplated three stages of flood control construction: (1) channel improvement below the city; (2) channel improvement through the city; and (3) construction of two detention dams above the city. Application was made to the state executive director of the Civil Works Administration for funds to put men to work on the first section of the proposed improvement program, and approval was given by the state administrator for an expenditure of \$367,000 for labor and \$6,000 for workmen's compensation insurance. Cost of engineering supervision was guaranteed by the county commissioners, and a fund of about \$50,000 was subscribed by the county, the city and citizens' committees, to meet the expense of equipment rentals and other incidentals.

**Channel Improvement**—Work on the first section consists of straightening, widening and deepening the channel of the Codorus River for 2.4 mi. below the city and of clearing trees and brush from adjacent land where the flow of water has been impeded at flood stages. Final improvement of the section calls for 260,000 yd. of dry excavation and 220,000 of wet excava-



TWO METHODS OF EXCAVATING are utilized on CWA reservoir job. Power shovel loads trucks while workmen dig trenches for cast-iron intake and outlet pipes.

empties into the river less than 1 mi. downstream from the city limits, the channel is made 1 ft. deeper. The completed section will provide for a flood of 24,000 sec.-ft. and is estimated to reduce the crest of a 35,000-sec. ft. flood in the city by 4 ft.

**Working Organization**—Speedy action marked the beginning of operations. Approval of the project was given by the state director at about 5 p.m. on Nov. 28. On Dec. 1, 100 men went to work, 50 on each shift. A second 100 was given work the following day. On Dec. 4 (Monday) an additional 250 was employed, and the total labor force, including both shifts, was increased at the rate of 250 per day until about Dec. 15, when the grand payroll aggregated 2,500 names. An additional 700 was put on later to bring the total up to 3,200. It was found that this augmented payroll was necessary to yield an average daily working force of 3,000, as some stayed home each day for miscellaneous reasons.

were on the job 10 hr. a day. Foremen were selected from fresh groups of inexperienced workmen as they arrived at the site. Several engineers needed to give lines and grades on the project were chosen from the list of York County unemployed. One timekeeper was employed to take care of each unit of 200 workmen, a total of 15 timekeepers being allotted to the two shifts per day.

In a few cases it became necessary to discharge men. No man was released without just cause. When a man was to be discharged, the foreman reported the case to the assistant superintendent. If after investigation the assistant superintendent approved, he filled out a standard form to be inspected by the superintendent on the same day. If the superintendent approved the recommendation, the release was made official and final. In the 27 working days, Dec. 20 to Jan. 20 inclusive, 27 men were dismissed, an average of one for each day out of a total payroll of 3,200 men.



**Small Tools**—Equipment purchased for the hand-labor work on this project consisted of 480 wheelbarrows, 1,332 round-point long-handled shovels, 496 picks, 67 axes, 48 mattocks, 18 cross-cut saws, 15 sledge hammers

by this method. Mr. Eastman considered this average satisfactory for former inside factory workers laboring under adverse weather conditions.

A faster rate of earth moving was attained by a small gang of 50 men

**LARGE HAND-LABOR FORCE** to load and push wheelbarrows takes bulk of 3,200 men employed on two 5-hr. shifts per day.



**NARROW-GAGE RAILWAY EQUIPMENT** is used to remove spoil loaded by hand from strip of river bank in front of sewage treatment plant.

and 15 crowbars. Long-handled round-pointed shovels were ordered for this and other CWA projects partly because this shovel has a wide range of utility and partly because it is the type of shovel with which many men outside the field of construction are most familiar.

In general, when moving earth by wheelbarrows, two men shoveled to each man who wheeled. A total of 100 teams, divided about equally on the two shifts, worked on the project. These units received 85c. an hour for both team and driver. On each shift, about 25 teams operated slip scrapers and the other 25 hauled dump wagons.

**Efficiency**—For all the men engaged in moving earth by hand, Frank H. Eastman, vice-president and general manager of Gannett, Seelye & Fleming Engineers, Inc., who was general supervisor of construction on the project, estimated that an average of 1 cu. yd. per man per 5-hr. day would be obtained from the shovel and wheelbarrow operations. This average meant a total of about 2,500 yd. per day moved

per shift on a section of river bank where the length of haul and a steep grade make it necessary to use narrow-gage, roll-over dump cars and two gasoline dinkeys. These gangs moved about 15,000 yd. from in front of the sewage treatment plant to build a fill for a proposed future boulevard along the river. The average quantity moved by this operation was 2 yd. per man per 5-hr. day.

**Power Equipment**—Draglines and shovels locally available were rented to supplement hand labor in difficult sections of the project. The rentals, which included fuel but not labor, were paid out of the fund raised by the county, city and citizens' committees. Two  $\frac{3}{4}$ -yd. steam draglines with 50-ft. booms and two diesel-electric  $1\frac{1}{4}$ -yd. draglines with 60-ft. booms excavated and cast earth from the channel in two of the heavier cuts. Most of this spoil had to be cast twice. Each of the four power excavators gave an average of 6 weeks' service prior to Feb. 15. To level the dumped earth, shape the dikes and banks of the channel, and pull out and haul away the large tree stumps, the project was equipped with four Caterpillar tractor bulldozers: two 30 hp., one 35 hp., and one 50 hp.

An important utility on the job was



**ON FLOOD-CONTROL PROJECT** at York power draglines excavate two heavy cuts in channel widening and straightening program.

top, an outside slope of 1 on 2 and an inside slope of 4 on 5. Following the completion of the present CWA work the inside slope will be concreted with an 8-in. concrete slab lining. An application has been made to CWA for this additional construction. Maximum height of the downhill embankment, from toe to crest, is about 28 ft.

About 10,000 ft. of 14-in. cast-iron water mains connect the reservoir with the pumping station and with the distributing system. These mains are being laid with CWA labor and are being paid for, in part, by CWA funds. A total of about \$52,500 was allotted by the Civil Works Administration, of which \$42,000 is for labor and \$10,500 for material and equipment rental. The borough of Danville is advancing about \$20,000 for materials and services, including workmen's compensation insurance. Liability and property damage also are assumed by the borough.

Official approval of the application was received at Danville on Monday, Dec. 18, at 10 o'clock in the morning. Receipt of the approval had been expected, and by noon 100 men were at work on the project. This force soon was increased to 150 men per shift, and on Jan. 4 the payroll was expanded to 200 men per shift, absorbing practically all the local unemployed.

According to W. K. Ward, superintendent, the men worked steadily on their 5-hr. shifts and produced about 85 per cent of what a contractor would demand of the same gangs. Five experienced foremen were selected from the list of eligible unemployed. J. B. Carpenter, vice-president of Gannett, Seelye & Fleming Engineers, Inc., was engineer in charge of the project.

A  $\frac{3}{4}$ -yd. steam shovel, two rollers and six trucks comprised all the power equipment on the job. On Jan. 3, when a *Construction Methods* representative visited the work, the power shovel was cutting into the hillside and loading three of the trucks with about 2 yd. per load. Two other trucks were hauling pipe, and the sixth unit was serving miscellaneous utility purposes. A 5-ton road roller then in operation was to be supplemented by a 10-ton roller within a few days. Equipment rental on the job was to total \$1,600, of which \$600 was for the steam shovel.

a portable steam tractor sawmill which was rented at the rate of 80c. an hour for the sawmill and equipment. This mill averaged about 4,000 b.-ft. of lumber per day, sawed from logs cut on the project—a total of about 300,000 b.-ft.

**Accomplishments**—It was planned to move all the 260,000 yd. of dry excavation by Feb. 15. According to the estimate of the engineers in charge on Jan. 28, it seemed probable that the major part of this schedule would be accomplished, provided no unforeseen conditions interfered.

#### DANVILLE RESERVOIR

Danville, a town of slightly less than 7,500 population, on the north branch of the Susquehanna River, for years has needed a distributing reservoir with a capacity sufficient to afford storage for fire protection and to eliminate continuous 24-hr. pumping, which now is required. Plans for a 3,000,000-gal. reservoir on a hill above the town, involving about 25,000 cu.yd. of excavation and embankment, already had been made. Because the reservoir offered a useful work project on which 300 to 400 of the town's unemployed could be put to work, the CWA director for the state approved an application by the borough of Danville on Dec. 15. As no one capable of supervising construction was to be found on the list of eligible unemployed, Gannett, Seelye & Fleming Engineers, Inc., was engaged to take care of engineering and management. This firm placed a resident engineer and a superintendent on the project.

Construction of the reservoir, which is located on a sloping hillside, calls for excavation into the side of a hill and for the construction of an earth embankment on three sides. The reservoir, which is rectangular, has a floor area 73x240 ft. and will have a water depth of 15 ft. and a total depth to top of embankment of 18 ft. The embankment has a roadway 16 ft. wide on the

# PAVEMENT WIDENING

**A** CENTRAL MIXING PLANT and a fleet of agitator trucks supplied concrete for 10 mi. of 11-ft. widening, 8 in. thick, on highway U. S. 1 in the vicinity of Woodbridge, Va. McGuire & Rolfe, Inc., of Washington, D. C., contractor on this project for the Virginia State Highway Department, equipped the job with a central mixing plant capable of producing 2.28-yd. batches. Nine to eleven hauling units transported concrete from the central plant a maximum distance of 5.8 mi. and delivered an average of 17 batches, or 39 yd., per hour.

**Construction Conditions**—The McGuire & Rolfe contract is part of a 30-mi. widening program between Washington, D. C., and Fredericksburg, Va. This program provides for increasing the 18-ft. width of the existing pavement to 29 ft. The widening strip is located on alternate sides of the highway in such a way as to reduce curvature, improve alignment and take advantage of topographic conditions.

## *Served by Central Mixing Plant and Agitator Trucks*

At points where curves in the old road are too sharp to be reduced sufficiently by this means, short relocations are made to bring the alignment within the requirements of modern traffic conditions. Work on the contract under consideration consists exclusively of widening. The large volume and high speed of traffic on the existing pavement added to the difficulties and hazards of the widening operations.

**Paving Operations**—Trucks equipped with Blaw-Knox agitator bodies hauled 2.28-yd. batches to the delivery point and backed to dumping position at such an angle with the edge of the existing slab that one dual-tired rear wheel remained on this slab and the other rear wheel passed on to a specially constructed timber sled resting on the subgrade. About 30 sec. was required for the backing operation. The

top of the timber sled, or platform, was flush with the surface of the old slab, and the device was light enough to be pulled forward by two men from one position to the next. When backed into dumping position, the truck discharged its entire load of 2.28 yd. in 1½ to 2 min. The concrete had an average 2-in. slump. It was necessary to have a man in the agitator body to clean it out when dumping. Four puddlers distributed the concrete from the pile deposited on the subgrade and leveled the mass roughly for the finishing machine.

Because of irregularities in the surface of the old pavement, a steel rail was laid on the existing slab to carry

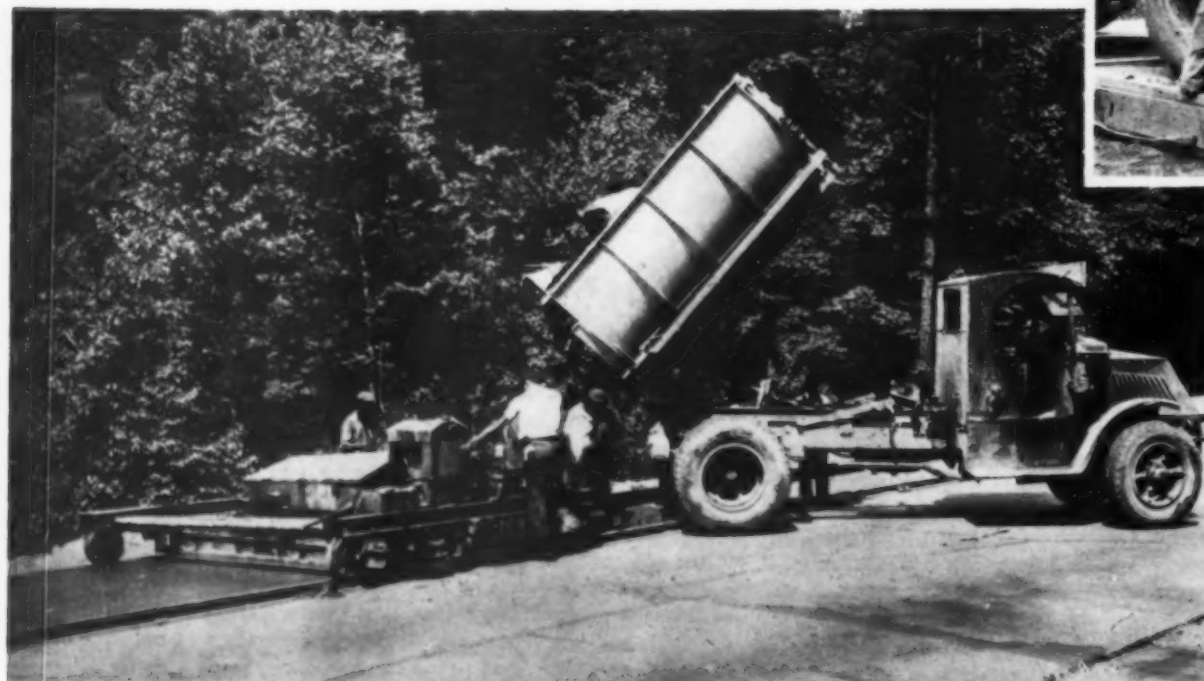
the inside wheels of the finishing machine. This rail was several inches back from the edge of the old slab, and in the finishing operations the fresh concrete was feathered out to some extent to fill hollows in the existing concrete surface. Wedge-shaped timber blocks were placed against the rail to pass the one dual-tired rear wheel of each concrete truck across this obstruction. The trucks pulled ahead two lengths of steel rail at a time to their new position. Wet burlap curing was employed for 24 hr., followed by earth. To wet the subgrade before paving and the earth cover on the slab during curing, the contractor used a truck tank sprinkler consisting



11-FT. WIDENING STRIP increases width of 18-ft. concrete pavement to 29 ft. on U. S. 1 between Washington, D. C., and Fredericksburg, Va. Agitator trucks deliver concrete from central mixing plant.



SKID BLOCK ON SUBGRADE supports dual wheels at one end of rear axle when truck backs to deposit load in widening strip.



AGITATOR TRUCK discharges 2.28-cu. yd. batch on subgrade. Inside wheels of finishing machine travel on steel rail laid on old pavement to bridge surface depressions.

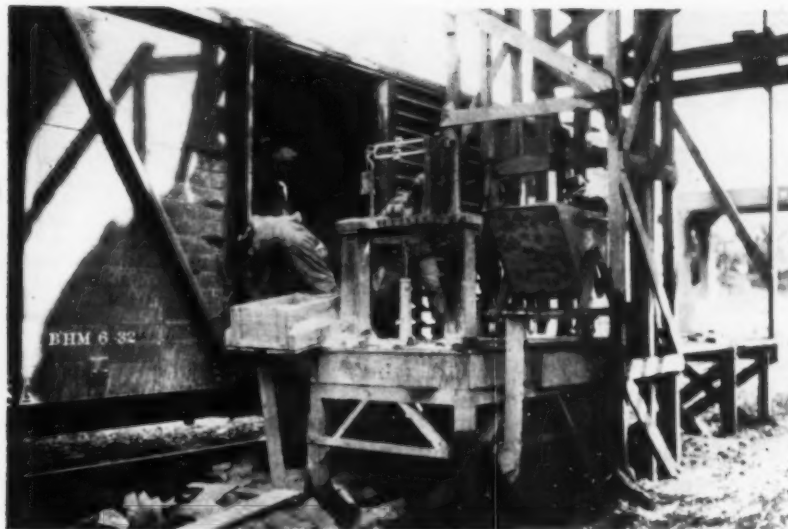
of an 1,800-gal. tank and Jaeger 500-g.p.m. portable pump mounted on a Brockway 3-ton truck. The outfit was equipped with a 4-in. sprinkler pipe 12 ft. long attached at the side of the truck by a swivel connection which permitted the pipe to be swung out at right angles to the line of travel. Holes ¾ in. in diameter were drilled 1 in. apart along the bottom of the pipe.

**Central Mixing Plant**—The concrete plant was located at Woodbridge on a railroad siding where bulk cement could be brought in by box car and aggregates could be hauled by light





W. A. BLANCHETTE (left), highway engineer, U. S. Bureau of Public Roads; R. S. ANDERSON, junior highway engineer, U. S. Bureau of Public Roads; and R. F. KRAUSE, engineer, McGuire & Rolfe, Inc.



BULK CEMENT in box car is shoveled into trunnion-mounted body of hand truck. After adjusting to correct weight on platform scale, workmen place truck on hoist for raising to upper level.

dump trucks from barges in Occoquan Creek, 2.6 mi. from the plant. Sand and two sizes of gravel were delivered to stockpiles from which they were elevated to three-compartment Blaw-Knox steel bins by a full-revolving Keystone crane operating a 1-yd. clamshell bucket. This crane originally had been equipped as a 1-yd. skimmer scoop and had served the contractor in grading for the 10 mi. of widening. The aggregates passed from the overhead bins into the weighing hoppers of a Blaw-Knox batching plant, from which they dropped into the charging hopper of the mixer.

Bulk cement was shoveled by workmen inside the box car into hand trucks which were pushed thence on to a platform scale flush with the floor of the car. After the weight of the loaded truck had been adjusted to give the 1,200 lb. of cement required for each batch, the scale man moved the truck on to the platform of a tower hoist which raised it to the upper level of the mixing plant. Two men pushed the cart along a short runway from the tower hoist and dumped the cement into the charging hopper. The bodies of the cement trucks were trunnion-mounted to facilitate dumping.

Charging of the 56-S Ransome mixer



CENTRAL MIXING PLANT receives aggregates by truck and bulk cement by rail. Crane charges bins with aggregates. Platform hoist raises cement trucks to upper level, where they are pushed across bridge and dumped into charging hopper. Mixer discharges into agitator truck.

with the ingredients of a 2.28-yd. batch required an average of 29 sec. Time for discharging averaged 18 sec. Adding these increments to the required mixing period of 1½ min., it is found that the potential maximum output of the central mixing plant was about 60.5 yd. an hour.

A crew of twelve men operated the plant. Eight workmen were engaged in handling cement: four loaded the hand

carts in the box cars, one weighed the material on the platform scale, one operated the tower hoist, and two on the upper level pushed and dumped the cement carts. In addition to the cement handlers, the plant force included one platform man to take care of batching and charging and discharging the mixer, one crane operator, one stockpile man, and a foreman.

Hauling Fleet—Nine agitator trucks

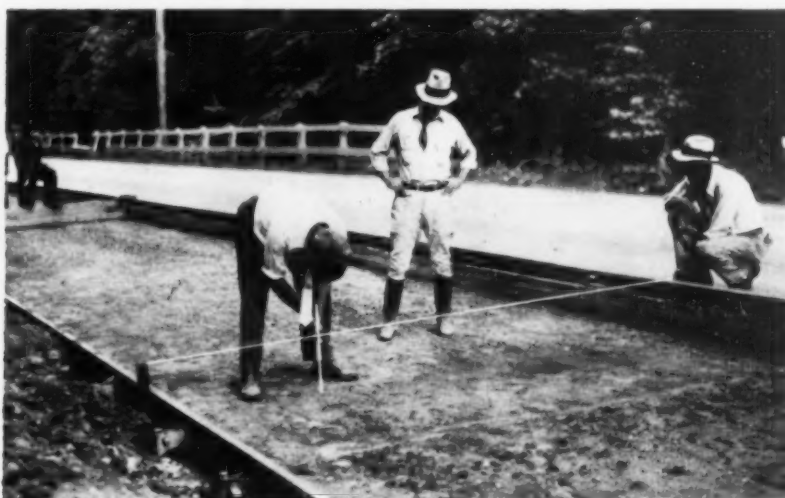
were rented from one commercial concrete firm, and two additional hauling units were obtained when necessary from another similar concern. A fleet of even eleven agitator trucks was insufficient to take care of the full capacity of the mixing plant on the longer hauls. If additional trucks had been available, construction could have been maintained at an average rate close to the mixing plant capacity of 60.5 yd. an hour.

For the average haul of 2.75 mi., eight trucks would have been required for maximum production. When a fleet of nine trucks was on the job, an average of only seven was actually hauling. Fifteen trucks would have been required to take the full output of the plant on the maximum haul of 5.8 mi. to the far end of the contract.

Supervision—G. Y. Carpenter, superintendent, was in charge of the work for McGuire & Rolfe, Inc., and E. L. Micou, resident engineer supervised operations for the Virginia State Highway Department. At the request of the contractor, R. S. Anderson, junior highway engineer, was assigned to the project by the Division of Management of the U. S. Bureau of Public Roads to make management and production studies.



SPRINKLER TRUCK equipped with 1,800-gal. tank and pump has swivel arm 12 ft. long for wetting subgrade and earth cover on fresh concrete.



TO CHECK SUBGRADE RAPIDLY, inspectors stretch cord attached at one end to wood block of same height as steel rail on old slab. Block clips to top flange of road form.

# Getting Down to DETAILS

Close-up Shots of  
Job Methods and Equipment

TAIL TOWERS on 25-ton cableways for building Boulder Dam for U.S. Bureau of Reclamation are equipped with inclined wheel tracks to take thrust of load and with take-up device to adjust sag and tension of cables across Colorado River Canyon.



"CROW'S NEST" in form of extended operating platform on one of West Slope Construction Co.'s fleet of 16 cu.yd. Mack trucks, used in building San Gabriel rock-fill dam No. 1 in California, enables driver to leave his seat, look toward rear and still maintain control of truck while backing up. Crow's nest is equipped with auxiliary throttle and air brake controls.



HOME-MADE SUBGRADER is used by Haas Bros., subcontractors under William Lough & Sons, to form base for standard concrete gutter on Illinois state highway project.—Photos from Ernst Lieberman, chief highway engineer of Illinois.



RUBBER EXPANSION JOINTS are employed on concrete hand-rail of Cleveland's new Brookpark viaduct over Rocky River (illustrated in this month's "News Reel"). Especially compounded Goodrich sponge rubber product,  $\frac{1}{4}$  in. thick, seals joints when concrete expands or contracts.



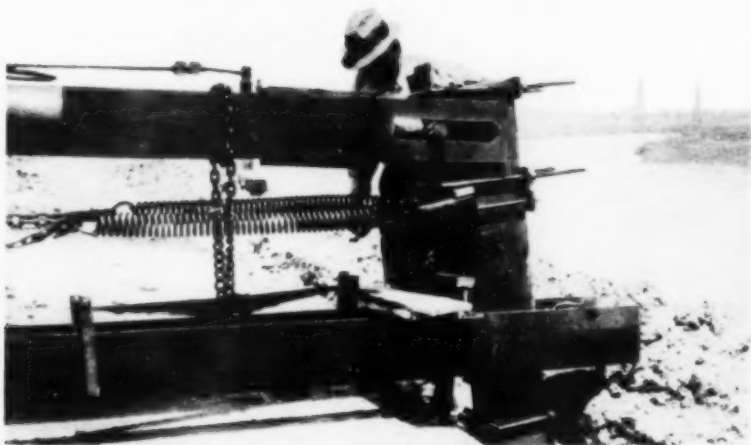
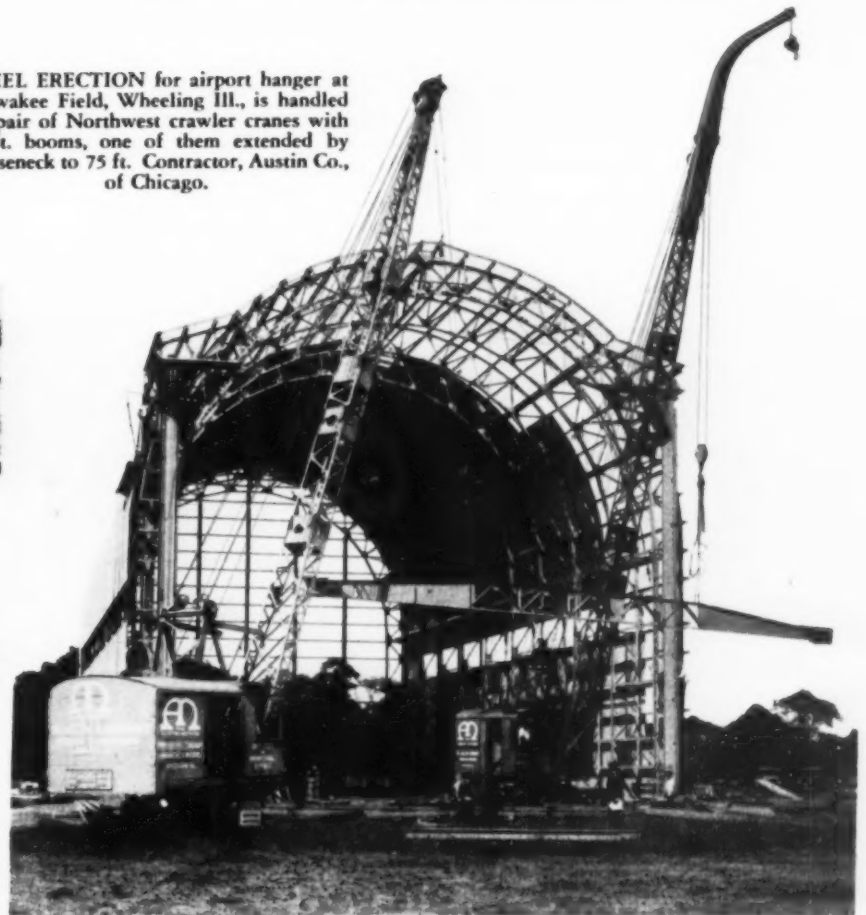
**FLOATING PILE-PULLING RIG,** consisting of 70-ft. steel frame equipped with two 7-sheave blocks for operating 15-part hoist line, pulls piles from forty-three 50-ft. diameter pockets of cellular steel sheetpile cofferdam surrounding 15-acre area in which Allen N. Spooner & Son, Inc., constructed portions of three 1,100-ft. piers for Department of Docks of New York City. Hoist cable thus rigged from steam 9x 10-in. double-cylinder engine has pulling capacity of 300 tons. Line is attached to Vulcan pile extractor which acts in conjunction with pulling tackle when needed to shake pile loose. To take maximum pull required for some piles

(estimated to be 225 tons) it is necessary to weld 1½-in. plates on both sides of webs of sheetpiles, which are straight-web sections from 46 to 96 ft. long.—*Photo from F. R. W. Cleverdon, vice-president, Allen N. Spooner & Son, Inc.*

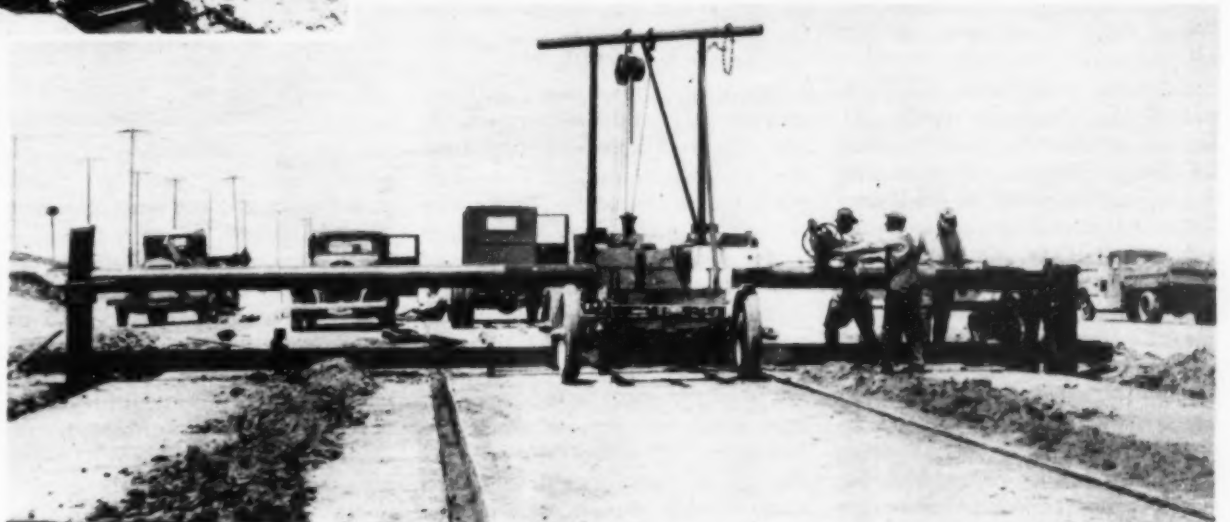


**DREDGED FILL** for track elevation project of A. T. & S. F. Railway in Oklahoma City is pumped into 45-in. diameter elevated steel cylinder, 200 ft. long, from which swinging steel spouts discharge into 30-yd. air dump cars of work train delivering material to place between retaining walls. Contractor for grading work, Leo Sanders, of Oklahoma City.

**STEEL ERECTION** for airport hanger at Palwaukee Field, Wheeling Ill., is handled by pair of Northwest crawler cranes with 60-ft. booms, one of them extended by gooseneck to 75 ft. Contractor, Austin Co., of Chicago.



**TO REPOSITION PAVEMENT SLABS,** displaced by earthquake of March 10, 1933, California Highway Commission used special jacking device illustrated herewith and developed by Maintenance Engineer Dennis and W. B. Cannon of Equipment Department. Assembly of steel plate, billets, rail, and well casing (right) to move, laterally, 50-ton sections of slab, consists of rectangle designed for working under theory of parallel forces. Oiljack, fed by small triplex pump, produces pressures ranging from 30 to 90 tons, latter being required to start movement of slab. Detail of working end of device is shown above. Outfit is built on 2½-ton trailer for portability. Cracks closed totaled 3,370 ft. in length and averaged 4.47 in. in width.—*Photos from California Highway Commission.*



# Helps to Successful Contracting

## XVII—Conclusion

Seventeenth of a series of articles on applying business principles to construction and making profits by avoiding costly mistakes

By HARRY O. LOCHER  
Contractor, New York

I AM FULLY CONSCIOUS that much of what has been said in this series of articles is elementary. I know, too, that experienced construction men have recognized it as such. But it has been my experience that the neglect of elementary things often has an uncanny way of affecting larger things: Relations are often strained; costs are increased, sometimes amounting to the difference between loss and gain. What follows is an attempt to sum up what has been said, emphasizing additional things that count.

**Common Sense**—Successful contracting, as is the case with almost everything else, depends upon common sense. Common sense, in turn, must be guided by experience. It means careful and prudent bidding. It means intelligent and deeply interested management.

**"The outstanding contractors of America have always been men whose word was their bond. They had the respect and confidence of all. They always dealt in the open and in the light. Somehow, good fortune almost always seemed to walk with them."**

And it means close economy. Common sense, too, includes business honor for those who do not value it enough for its own sake. Unethical methods and short cuts never fail to rise up to haunt the man who practices them. The outstanding contractors of America have always been men whose word was their bond. They had the respect and confidence of all. They always dealt in the open and in the light. Somehow, good fortune almost always seemed to walk with them.

Ambitious young men should remember this when entering the construction industry. They should be careful when they begin. Some places are fertile ground in which they will grow healthfully; here they will receive aid and encouragement. Older men will discharge the debt they owe to a generation which has gone in passing on to others the aid which they received when they began. The young man's future depends largely upon the influence of his early training, experience and impressions. There is nothing else about which he should be more careful. He must acquire the discrimination and

the backbone to select and be guided by what is wholesome round about him. He must not allow himself to be influenced by the shallow and the unethical. He cannot do this and become a credit to his industry.

**Over-Anxiety**—Too many contractors confuse action with direction. They have an irresistible urge to keep busy—if at nothing else, at taking reckless chances which may ruin them. Often it is sensible and profitable to remain completely inactive, rather than to have valuable time and money tied up in a losing job. Such jobs are usually obtained as a result of being too anxious. It is much better judgment to keep time and money available for the good opportunity which is sure to come along. If time and funds are both tied up in low-priced, losing jobs, there is nothing you can do but watch the good opportunities pass you by, while you wrestle to cut down losses on some job you "just had to have."

The over-anxious bidder is almost always in hot water. He usually gets his work at a price way below any of the other bidders. This means a psychological sock on the jaw right off the bat. He is usually groggy until the end of the job. And when that times comes his best friend—his bank account—has deserted him. All of this is the result of being "over anxious" and bidding carelessly. More than one contractor's downfall dates from the day he put in a ridiculously low bid and was heralded as the "successful" bidder. As the level-headed contractor, who was quoted in an earlier chapter, often said, "Keep bidding safely and prudently, and every now and then you will get a good job and make some money." And it was this same contractor who said, "There is no better tonic to keep a man pepped up than to earn some money now and then." But it is seldom done on the "just-have-to-have-it" job.

**Size of Operations**—Size is too often confused with successful net results. It has happened that companies operating over a wide area, with offices in principal cities, have earned less real money in a year than some prudently managed shovel outfit hardly known outside of its own state. Often, too, much money is absorbed in unnecessary overhead expense. Some modern offices are based on a desire for show and their cost is out of all proportion to the amount of work handled in them. When the volume of business makes them necessary they are, of course, needed. But when their existence rests on ostentation or

on imaginary necessity, they are dangerous signs.

On one job being done out in the mountains, 400 miles away from the home office, the overhead charge made necessary by the big home office layout would have been considered a highly satisfactory profit by some contractor camped at the site and doing 95 per cent of all the office and administrative work there. Non-productive overhead is a profit-killer that always gets his man—just give him time!

A well-known and successful contractor was low bidder on several contracts near one of the largest cities in the country. On one of the sections he took in as a partner a much younger man. Now that he had become a contractor, the young partner gave vent to some fancy ideas about city offices and so-called prestige. Immediately he wanted to open up a sumptuous office in the nearby city. "What for?" the old-timer asked. "It will give us a better standing", the new partner replied. "Huh, you think it will, do you?" replied the veteran. "If you should open such an office more people down here would have business up there than you can think of. Here is where the job is and here is where the only office will be. And here is the place I expect the people to stay who are to run things."

One of the largest contracting firms in the West, a firm which did millions of dollars worth of work, had only two small rooms in a medium-sized city. The secretary of the company, a compe-

**"Successful contracting, as is the case with almost everything else, depends upon common sense. Common sense, in turn, must be guided by experience."**

tent financial man, had charge of this office. He was out on the line a great part of the time. There were never more than two or three persons in this office. Little more than the handling of the larger money transactions of the firm was done in it. Practically everything else was done on the jobs. There, everyone was familiar with things and knew exactly what was going on.

If rock excavation for some powerhouse foundation off in the hills several states away shows that 20 per cent of the cost is for home-office overhead, the

company handling it is on the skids. There is no single chance that they can survive. They are top-heavy and are bound to fall.

Contracting is a business to be learned, as is any other business. It is not a poker game—nor is any other business—in which the inexperienced can sit occasionally, and win. Sometimes a successful contractor errs in thinking he will be a wizard at anything he attempts. The odds are more than one hundred to one that he is not the wizard he thinks himself to be. Far be it from me to have the presumptuousness to say what contractors should do with any money they have earned. This is wholly their own business. But, in passing, I cannot resist saying that it seems indeed unfortunate that so many

**"Size is too often confused with successful net results. It has happened that companies operating over a wide area, with offices in principal cities, have made less real money in a year than some prudently managed shovel outfit hardly known outside of its own state."**

men who worked so hard, depriving themselves of so much, and who succeeded in their chosen work, should, often in their late years, venture off in directions in no way related to the work that they had spent their lifetime learning and lose their all! This has happened again and again. Each one thinks he will come through. Few do!

**Ambition To Expand**—Ambition to expand too fast—to spread out too thin—has wrecked many promising contractors and many who had arrived. To grow solidly, a contractor must grow normally. He must keep within the bounds of what he can do without undue stress. There is a danger zone into which many have strayed, and perished.

Division of interests, too, has kept many contractors from being as successful in their business as they might have been. The business is a man's size job in itself. The contractor who concentrates upon it will more than likely be most successful in it. When other interests, or maybe some hobby, begin to steal much of his time and thoughts, the ground beneath him is getting shaky. No tail has ever successfully



wagged a dog. Usually, when this is tried, the dog dies.

**Detail**—Contracting, too, is a business of detail. This has been stressed all along. Too few contractors value highly enough close attention to necessary detail. Volumes could be written

**"To grow solidly, a contractor must grow normally. He must keep within the bounds of what he can do without undue stress. There is a danger zone in which many have strayed and perished."**

showing the effects of attending to or not attending to important detail. But it should be the right detail. Some men become all aglow over minor and unimportant things, while really important and costly detail is escaping their notice entirely.

A night superintendent came to a certain dragline just before midnight. The foreman was raising Cain about what he thought was an extra light on the dump. But he was not bothered by the fact that the careless operator had been swinging his 4-yd. bucket back and forth several hours with nearly a yard of muck stuck in the back of it. The bucket had probably made 200 trips to the dump in this condition. At least \$80 had been lost, while the foreman was sputtering about 10 or 15 cents' worth of light. Important as a detail is, it is well to remember that Josh Billings once said, "There is no economy in straightening pins."

Another important thing about detail is that men in authority should learn to delegate it. Delegate it to those who will faithfully attend to it, to those who are keen enough and interested enough to recognize it when they see it. A man in a responsible position cannot afford to give too much of his time to detail, but he should know without question that all detail was being properly taken care of.

Whole-hearted cooperation between partners is another key stone. A contract has to have in it at the beginning a most unusual profit and a great deal of good luck to weather the shocks and drains which would result from non-cooperating partners. Tact and diplomacy are always required in such situations. And bigness! Here is where a man often has the opportunity to show how much, a man he really is, to show whether he is a 45-caliber type, or only a 22.

**Lavish Spenders**—Lack of experience and a disinclination to seek competent advice often bring about unfortunate results. An amusing incident comes to mind. A well-known contractor was visiting several sections of aqueduct work. As he walked up to a

shovel working in one of the cuts the operator, who had formerly worked for him, jumped from the machine and greeted him. "How about a job?" he inquired.

"What's the trouble with the job you have?" the contractor asked.

"Well", said the operator, "I'm working for two young chaps who had some money left them. They are paying me—a month (he named an amount nearly half as much again as the customary rate) to run this shovel. It's just the same with other things. They surely are spenders; will buy anything anyone asks for. They are good fellows and I like 'em, but you know as well as I do that when anybody spends like they do they can't last long. They lack experience. So I'm just sort of looking around before the bust-up comes."

Almost as dangerous as the inexperienced man, is the "know-it-all" type of man. He is always getting himself and others into trouble. He is rarely liked and is usually shunned by those who could help him. He does not want to be told anything by anybody. Always the time comes when he takes the final count. Such men never ask advice and always have an alibi for their mistakes. Both of these traits indicate a lack of common sense and a non-cooperative spirit. A well-known engineer in charge of the construction of a big dam hung a large blueprint at the back of his desk, which read, "To hell with excuses." He said it worked.

A cooperative spirit! This is the vital element which is necessary to leaven the entire organization with a fine esprit de corps, the vital spark that fires the earnest enthusiasm of an entire organization successfully and profitably to accomplish the completion of a construction job. And nothing is greater evidence of real common sense. Nothing is greater evidence that a man is "too big" to be little. There is might and strength in numbers working together whole-heartedly for a common purpose, a satisfaction and a safety that cannot possibly exist in a non-cooperative, frictional organization.

**Seeking Advice**—When any doubt arises regarding situations which are important, it is but common sense and

good business to consult the man "who knows", either the man on the job "who knows", or an outsider who does. Many dollars have been foolishly and needlessly lost because of failure to get sound advice in certain perplexing and untried situations. If it is not within the organization, it is but simple prudence to get competent outside advice on financial problems, estimating, taxes, depreciation and obsolescence, as these affect costs and taxes. Strange as it may seem, there are some men who would rather take a chance on something they are totally unfamiliar with, than admit frankly that they knew nothing about the matter. This is risky business and almost always costly. A tremendous amount of money is lost by contractors each year through failure in this direction.

Extravagance in small things is a bad example and tends towards a looseness in larger things which often proves costly.

Pride of workmanship is a healthful influence on a job. Work well done adds to the reputation of a contractor. Often, too, it is more economical to do work right than to do it in a slovenly manner. Tolerated slovenliness is a bad example to men and a destroyer of job morale. Many times, too, slovenly work has to be done over again. Then the cost is generally more than if done right in the first place.

With the dazzling evolution that has occurred in equipment and methods, it is but plain common sense deliberately to keep posted as to what is happening. Being behind the times is a disadvantage which often cannot be overcome. You are beaten before you start, even though having much merit in other directions. The contractor using up-to-date equipment and methods has little to fear from the user of equipment and methods of a day that has gone.

To be aloof to competitor's methods is to lose opportunities which yield ideas that can be used to good advantage. Every experienced construction man has learned things which would be of help to every other construction man. There is nothing to lose and much to be gained from an exchange of ideas. It

is helpful to the individuals and to the business generally.

**Good Will**—Building up good will in the locality in which work is being done is a factor that counts for much. It smooths things mightily to get along well with the folks among whom you

## COMING

NEXT MONTH, George E. Deatherage, construction superintendent, will continue Mr. Locher's theme of successful contracting practice with the first of a series of four articles on:

**Simple Methods for Job Unit Costs  
Preparing Bills of Material  
Unit Cost Reports  
Handling Plans at Field Office**

are working. A certain right-of-way lay for a quarter of a mile through a peach orchard. When the job was let the fruit was about ripe and nearly ready to be gathered. When the contractor moved in and fences were pulled down, large-scale stealing and tree injury began. The orchard owner complained. The contractor placed night and day watchmen in the orchard. The stealing and tree injury were stopped. The owner was so pleased that he granted this contractor easement and other privileges which far exceeded the cost of the watchmen. The contractor had gained his good will. Every job offers many opportunities to build local good will among those who can be of great help. Too often, the opposite course is followed. Then, at the end, some unexpected costs have crept in and the gain is not as great as was expected.

There is no gainsaying the fact that the construction industry is weak in places. There is room for much improvement in many directions, as there is in all other industries. But in it are men who are its foundation stones. These men would be the foundation stones of any industry. These are the men upon whom the ethics and wholesome development of the industry depend, the real "old men" of the business. These are the ones whom all right-thinking construction men should follow. Upon them depend the health, the stability and the good name of the industry. May they multiply!

In talking about helps to successful contracting it would be an unpardonable omission to say nothing about the many loyal, self-sacrificing women who have done their part in it, women, out in desolate mountain and lonely river bottom camps, and in strange places far from home, who have stood by their men, inspiring and encouraging them when things seemed dark, sympathizing with them and standing firm through thick and thin. These are real women. To them contractors are proud to acknowledge a debt of gratitude for constant help and inspiration in the journey toward the goal of successful contracting.

## "Helps to Successful Contracting" to Appear in Book Form

WITH this installment Mr. Locher concludes his series of articles on "Helps to Successful Contracting", which have been appearing regularly in "Construction Methods" since October, 1932. What he has written has struck a responsive chord among construction men. Scores of letters have been received commending the sound counsel he has offered in applying business principles to construction and making profits by avoiding costly mistakes.

Starting with the inspection of the site of the job, estimating and bidding, Mr. Locher has carried his discussion through every important phase of contract work, including construction equipment and methods, organization, cost-keeping, progress schedules, relations with employees, sub-contractors, engineers and owners, night work, cleaning up and moving to yard or new job, forms of contract, surety bonds and accident preven-

tion. His treatment of these subjects has been distinctly practical, rather than academic. With a background of years of varied construction experience, he has been able to talk convincingly to construction men in their own language and to illustrate statements of general principles by specific, colorful examples from the ample fund of his field contacts. Through all of these articles has run a rich vein of human understanding that has added warmth and vigor to what otherwise might have been a cold, lifeless recital of fact and opinion.

So keen has been the interest in Mr. Locher's articles and so widespread the demand for their preservation in a form more permanent than the pages of a monthly magazine, that our subsidiary, the McGraw-Hill Book Co., has decided to assemble them in a book, to be published at an early date.

—EDITOR.

# Cableways Place Concrete in BOULDER DAM

## Part Two

IN LAST MONTH'S ISSUE—Part I of this article on concreting at Boulder Dam dealt with cement, concrete mix, electric train haulage from mixer plant to cableways, special 8-yd. concrete buckets and the six main cableways serving the dam-site and power house. Part II, below describes in detail the methods and equipment for placing the concrete in the columnar blocks forming the main body of the dam and the refrigeration system for cooling the huge mass of masonry.—EDITOR.

AS EACH empty concrete bucket is brought to rest in one of the two empty compartments on the car, two men transfer the double pair of hoisting lines, one to the rim and one to the doors. As soon as this is completed, the signalman, perched nearby, directs the cableway hoist man, unseen and hundreds of feet above in the head-tower operating room, to start the bucket on its way. The load is taken on the pair of lines attached to the doors and the bucket is raised gradually off of the car. Another signal telephoned to the hoist operator sends the carriage on the track cable speeding out across the canyon at a surprising rate.

During this rapid forward movement of the carriage the bucket starts to swing slowly out across the canyon like a huge



FORMS in place for pouring, in 5-ft. lifts, columnar blocks of concrete for main body of 730-ft. Boulder Dam. Full-size blocks (in center) measure 55 x 60 ft. in plan.

pendulum, continues on past the mid-point and far beyond the carriage, approaching a position over the place of pour. Control of its movements is assumed by another signalman stationed on the block in the main body of the dam where the concrete will be deposited and connected in on the same signal and telephone circuit with the hoist operator and the other signalman at the train track. As the bucket approaches the end of its swing the carriage is ordered forward again at full speed and is brought over the bucket at precisely the correct instant to stop its motion. With amazing precision this movement completes the horizontal transporting of the 20 tons of concrete and bucket across the canyon and it is then lowered with hardly any further lateral adjustment to the proper position in the form.

After some slight correction of position, as directed and spotted by the foreman in the placing crew, it is finally brought to rest on the surface of the concrete. If the safety latches do not trip automatically at this point they are tripped by hand and then the crew steps back while the bucket is picked up on the hoisting line attached to the rim. This motion tends to lift the bucket off the concrete as the doors open and the 16-ton mass of concrete slumps into final position. There is some rebound on the line but with hoisting continued the empty bucket does not return close

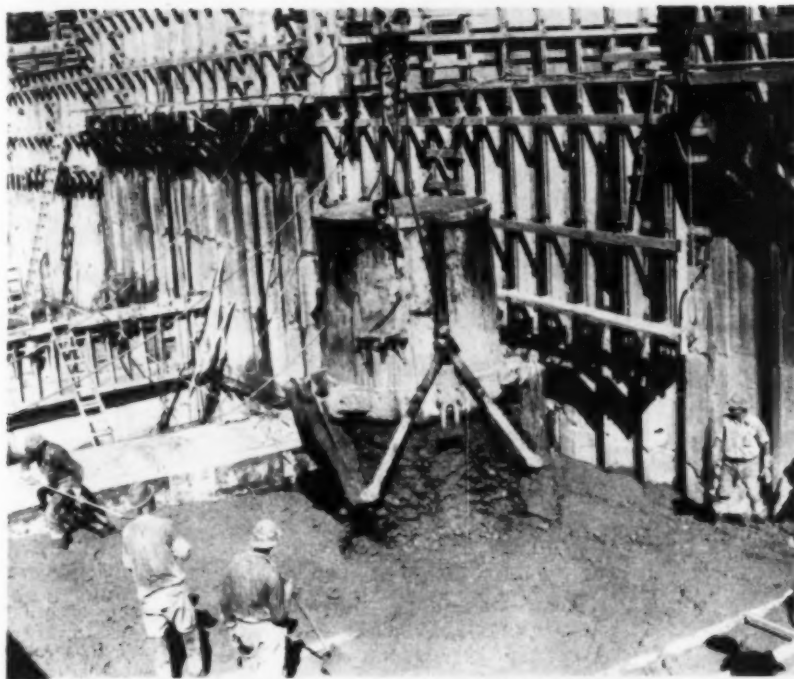


BLOCK STRUCTURE of dam, as seen from foot-bridge spanning canyon. On right (Nevada) canyon wall is trestle for trains delivering concrete in 8-yd. buckets.



FINAL CLEANUP of block of concrete just prior to pouring new 5-ft. lift. Debris placed in bags for removal. Water drains away through pipe in corner.





**BOTTOM-DUMP BUCKET** of 8-cu. yd. capacity, delivered by cableway, discharges batch within forms of column block.

to the surface of the concrete. As soon as the bucket is lifted and emptied the hoist operator transfers the load to the lines attached to the doors which are thereby closed and locked. The bucket then returns on a similar swing and finally is landed back on the car.

The precision and rhythm of this cableway operation is one of the most remarkable features on the job. Considering the length and size of the cableway, the vertical distance between carriage and load and the speed at which the loads are handled, the rapidity of this placement method is remarkable. It is also more remarkable considering the human element involved and the fact that judgment and skill are such large factors in the operation. The signalmen are mostly boys proved to have a natural sense of rhythm and quickness of judgment. They are trained by giving them a duplicate headset and having them sit near the regular signalman and listen in on the order for a shift or two.

Originally, the plan was to place 5-ft. lifts of concrete in 1-ft. layers over the entire block but because of climatic conditions at the site the surface dried out so fast that this was not feasible and as a result the buckets of concrete are dumped at the downstream side of the block for the full 5-ft. lift and then the concreting is carried toward the upstream face with its natural slope. This procedure has a natural tendency to wedge the concrete against the upstream form as the final action of placing each lift. With the 3-in. slump of the concrete and the weight of the 8-yd. mass, there is no economic advantage in using vibrators except in the corners of forms and around drain pipes. Little work is done on the concrete after it is deposited except a small amount of spading near the sides and pushing the cobbles beneath the surface.

The placing crew usually consists of a foreman and seven men. The average time for completing a 5-ft. lift on an average block is from 1 1/4 to 1 1/2 hr.

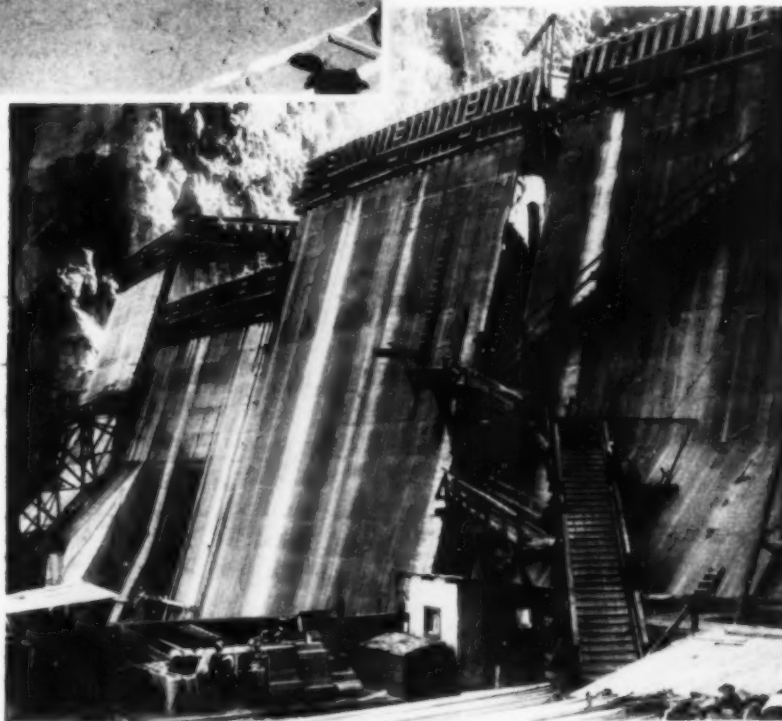
This method and sequence of placing concrete is in use on practically all of the 220 columnar blocks which make up the dam. These blocks vary in size from 55x60 ft. for some of the larger ones on the upstream face to a minimum of 25x30 ft., with an average of 1,430 sq. ft. in area. Concrete is placed in 5-ft. lifts in each block with a specification requirement of a 72-hr. period between lifts.

The relative elevation of the blocks is maintained according to a definite schedule. Beginning with the 8-ft. radial slot left in the center of the structure for the headers of the cooling

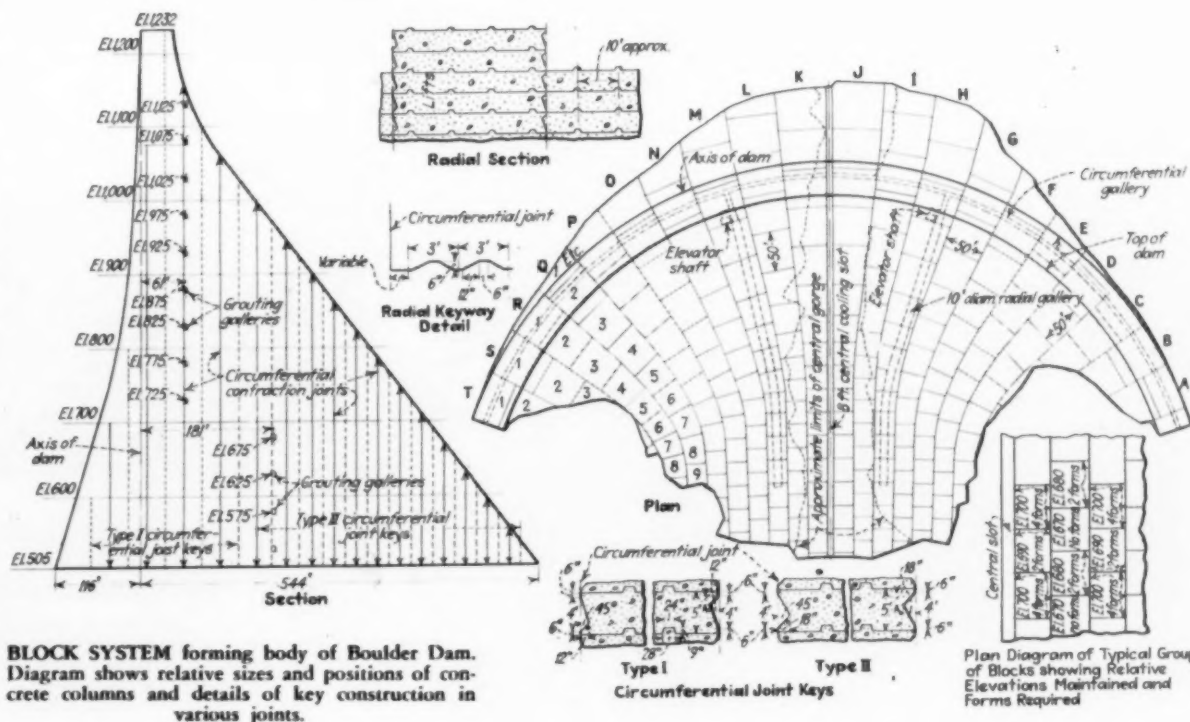
system, the first row of blocks on each side is maintained as a high row with the next row toward each abutment maintained approximately two lifts or 10 ft. lower and this relative height is maintained for the succeeding alternate rows toward the canyon wall. In addition to the alternating heights of rows, the individual blocks in each row are also kept about 10 ft. apart vertically, giving a maximum variation averaging 30 ft. from the high blocks in the high rows to the low rows. This schedule of block elevations is in keeping with the specification requirement for not more than 35-ft. difference in elevation. This relative arrangement of block elevations is clearly shown in several of the illustrations.

As the result of the system of blocks and their elevations, the form requirements were well established in advance. The corners of each block rise vertically which means that a set of forms, constructed for a given block, may be reused, with necessary maintenance work, from the bottom to the top of that block. The higher blocks of the high rows, obviously, are formed on all four sides. The lower blocks of these high rows are formed on the two sides, the higher blocks of the lower rows are formed on the upstream and downstream faces and, lastly, the lagging blocks are poured directly against concrete on all four sides.

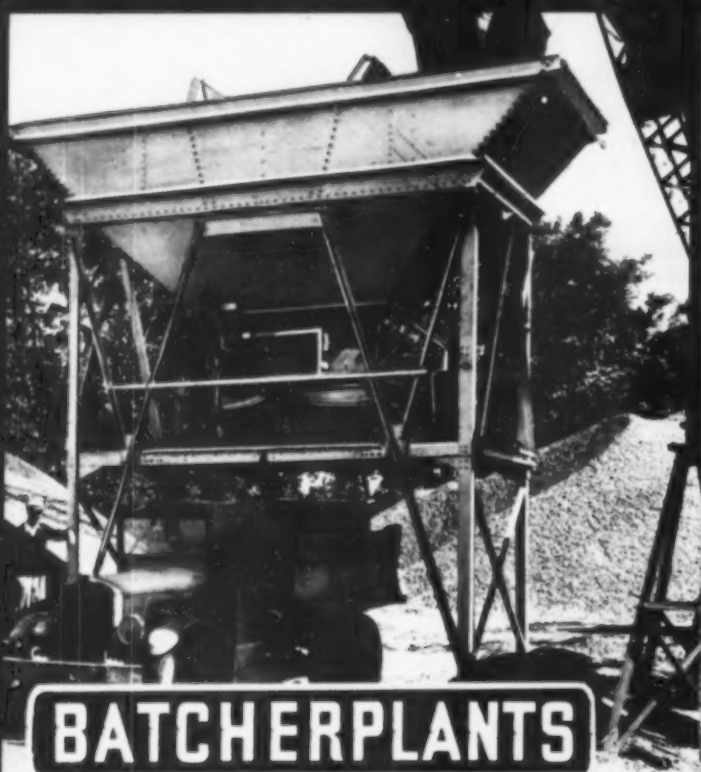
Except for the fact that forms are built in complete panels for the individual blocks and are used exclusively for that particular block, the formwork does not differ materially from usual practice. Forms are of the cantilever type built of timber with metal facing. They provide for a 5-ft. lift of concrete and the vertical timber members extend down an additional 5 ft. against the previous pour. They are bolted to two rows of bolts in the concrete. In addition, the tops of the forms are partially



**UPSTREAM FACE** of dam, looking toward Arizona side of canyon. At mid-section is slot for cooling system of piping carrying refrigerated water.

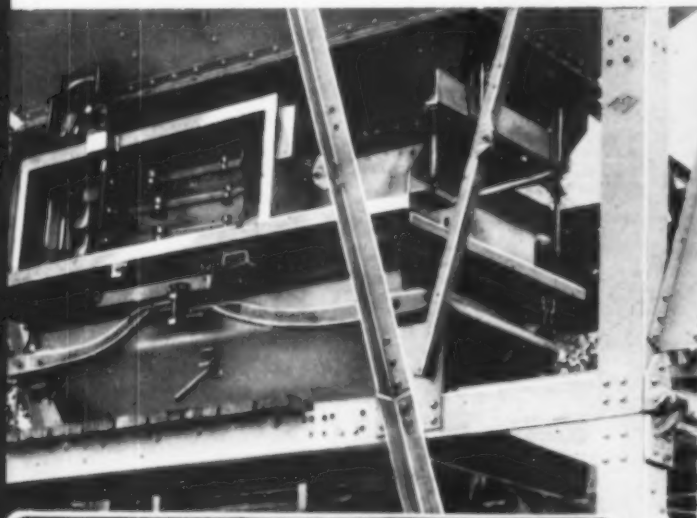


**BLOCK SYSTEM** forming body of Boulder Dam. Diagram shows relative sizes and positions of concrete columns and details of key construction in various joints.



## BATCHER PLANTS

Portable self-cleaning bins equipped with automatic, semi-automatic or manually controlled weighing batchers; all sizes to fit all job conditions and specifications. The most modern proportioning machinery ever offered. Designed especially to help contractors to profits where competition is keen.



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Blaw-Knox AUTOMATIC AGGREGATE WEIGHING BATCHERS are provided with push-button control for starting feed of material into the weighing hopper; with automatic cut-off when desired weight of material is reached. Furnished for any required number of aggregates and cement.

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Blaw-Knox TRUKMIXERS and Agitators are the last word in self-contained, automatic control. Built for long life with low maintenance cost. Combining strength and sturdiness without excessive weight. Made in 1, 1½, 2, 3, 4 and 5 cu. yd. capacities.

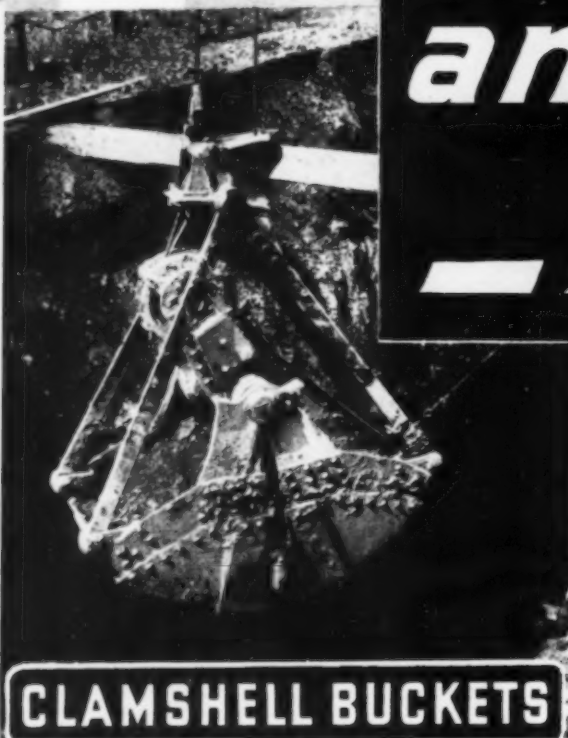


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## CLAMSHELL BUCKETS

Blaw-Knox Buckets will be found at work for contractors who keep careful records of maintenance costs and know which buckets are most profitable to use. Blaw-Knox also manufactures a complete line of dragline and concrete buckets.

Yesterday's equipment can't build today's roads—at a profit. Blaw-Knox equipment is trouble-free and speedy—low maintenance costs. It has been tried on the toughest jobs. (Blaw-Knox is ready to build roads of thoroughly modernized equipment—new developments ready to be used cheaper and better—tuned to the latest methods. (Buy new, buy

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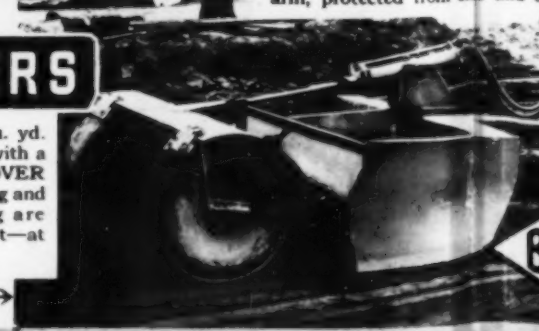


## BULLDOZERS

The Blaw-Knox Hydraulic BULLDOZER moves more dirt, less cost. Easy and quick to install on tractor—two way control, with positive downward pressure control the curved digging bowl—speedy bulldozing. Mechanism inside the bowl arm, protected from dirt and damage.

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Dirt moving costs of 5c per cu. yd. and less are not a bit unusual with a Blaw-Knox Hydraulic DIRTMOVER on the job. Dirt moving, grading and widening, cutting and filling are DIRTMOVER jobs. Cheap dirt—at lower and lower cost per yard.





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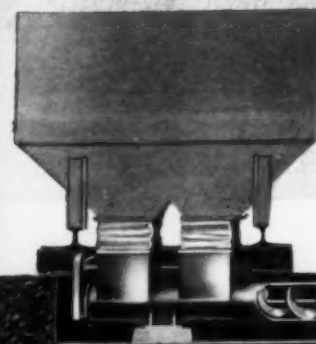
ment cannot compete to build to-  
a profit. (Here is new equipment,  
speedy—made to reduce construc-  
been tried and proved on many  
x is ready with this complete line  
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er—tuned to today's construction  
ew, buy now—insure your profits.

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Hydraulic BULL-  
more dig, less cost.  
to install on the  
y control, with posi-  
pressure control of  
g bowl—speedy bull-  
ism inside the side  
from dirt and dirt.



### BULK CEMENT PLANTS

The Blaw-Knox Bulk Cement Plant is a decided departure from old sty-  
methods of handling and batching cement. It is planned and designed from the  
viewpoint of the practical contractor. It is a flexible unit which can be adjusted  
to meet varying methods of cement delivery—by box car, by truck, or from  
hopper bottom cars. 50 to 350 bbl., capacity.

### ROAD FORMS

Here it is—the husky Blaw-Knox ROAD FORM which answers  
the demands of contractors for a sturdy and rugged form. Strength-  
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highway specifications. The Staking System stays put—rigid under  
all construction conditions. The Lock-Joint, STRENGTHENED,  
prevents waves in the road.

A REAL BRACE  
Stake pockets rivet-  
ed to head and base  
of form.

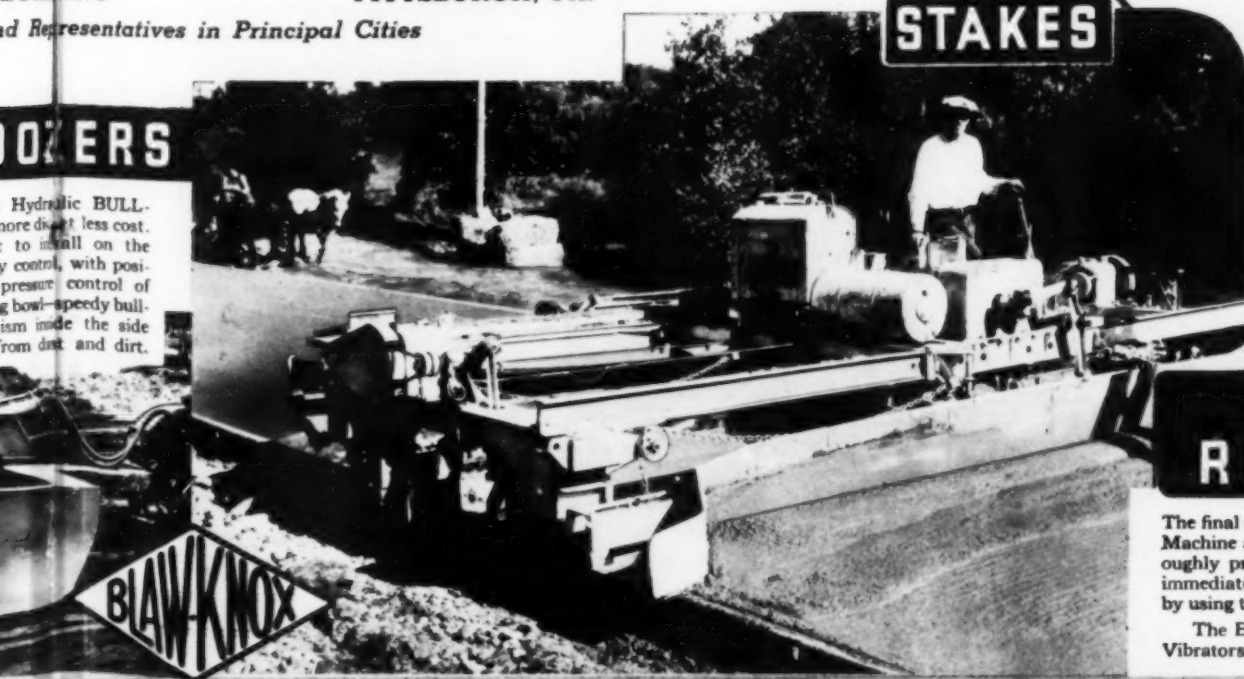
REINFORCED  
LOCK JOINT

1"  
STAKES

### GAS-ELECTRIC ROAD FINISHERS

The final touch of modernization has electrified the Blaw-Knox Finishing  
Machine and added new features of great value to the contractor. Thoroughly  
proved on many miles of actual road construction. Ready for  
immediate shipment. Contractors will immediately increase their profits  
by using this new machine regardless of their present equipment.

The Blaw-Knox Gas-Electric Finisher can be equipped with Electric  
Vibrators—also all attachments for bituminous paving.



restrained by wires. The illustrations indicate the details of the form construction, manner of placing, moving and details of grout connections.

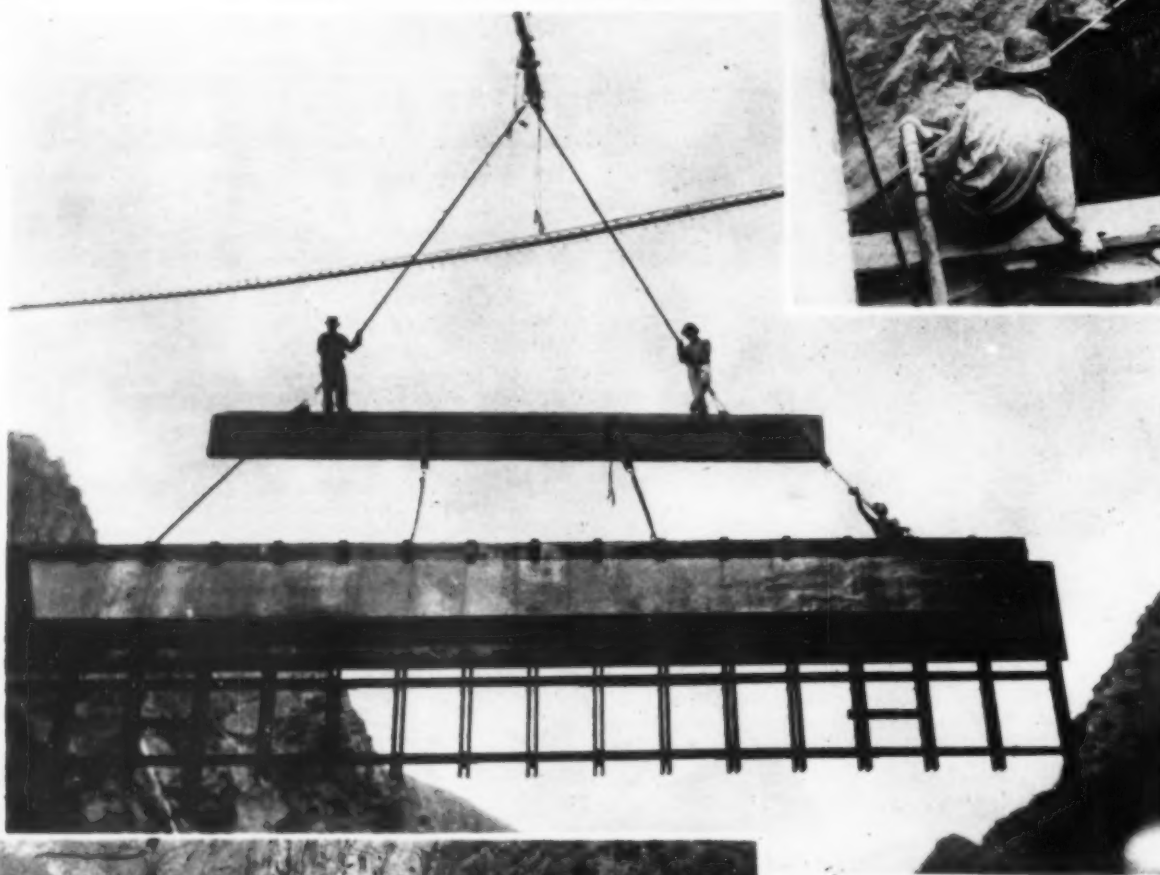
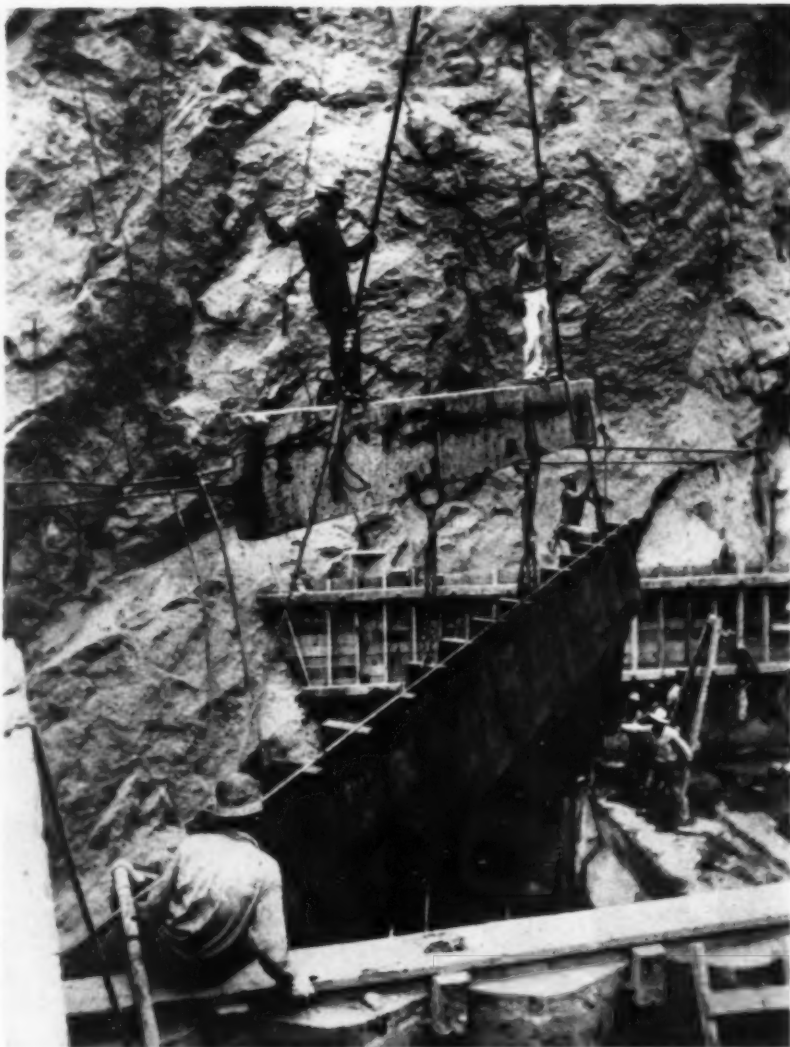
One important feature in the operation of the forms is the fact that they do not need to be moved from place to place over the structure but are merely lifted vertically 5 ft. by chain jacks for each lift on the block. If it is necessary to move them, they are lifted as a unit with a header beam, as shown, which eliminates dismantling and reassembling. The metal lining of the forms is oiled before each lift of concrete is placed.

Specifications require that all horizontal construction joints be kept continually wet between the placing of lifts and that the sides of the blocks be kept moist for a period of two weeks. The sides of the blocks and the faces of the dam are kept wet by perforated pipes attached to the lower ends of the forms.

Sprinkling of the top surface of the blocks must be done by hand and during the hot weather this operation required a crew of seventeen sprinklers during the day shift and twelve during the night.

Along the abutments, where the blocks are not up to regular size, it is difficult to use the regular buckets because of the possibility of damaging the forms and injuring the crew in the small area. For these reasons, these blocks, until they have reached standard size, are poured by means of a 4-yd. Rex moto-mixer or radial-gate bucket handled by cableway. This operation permits a more regulated flow of concrete and better control. Concrete for this purpose, as well as the concrete for the spillways is produced at the high-

**FORM UNIT** (below and at right) is moved into place by cableway, with lines extending to timber header support. Below form is timber tail-piece which is bolted to surface of concrete block.



**METAL LINING** gives smooth surface on inside of wooden forms. Forms are set to receive pour for 5-ft. lift of concrete and are guyed by inclined tierods.

level mixing plant and moved to the cableways either by truck or train.

**Rates and Progress**—For several months the area on which concrete is being placed has remained about constant with a thickness of about 500 ft. in the radial direction and a length of 400 ft. along the upstream face and 300 ft. along the downstream face. This area represents a concrete volume of about 32,000 cu.yd. per 5-ft. lift. The number of blocks under pour is sufficient to provide for continuous placing without delay resulting from the 72-hr. limit between pours on any one block. This area will remain fairly constant for several months of concret-

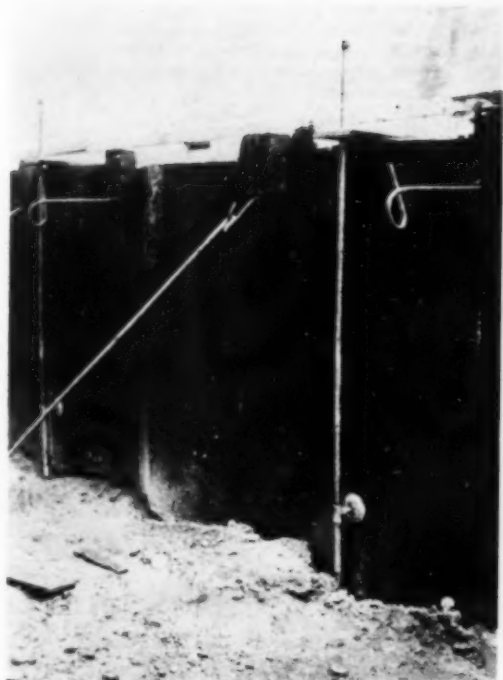
ing, with the distance between faces decreasing to compensate for the increasing width between abutments.

Concrete placing in the dam began in June, 1933, and the output gradually increased each month until 175,337 cu. yd. were placed in September and this was followed by the unprecedented concrete placing record of 204,572 cu.yd. during the month of October. At the end of October, 630,271 cu.yd. had been placed in the dam. For extended periods concrete has been placed at an average rate of more than 6,600 cu.yd. per day and the maximum day's output was 7,883 cu.yd. (2-min. mixing period at that time).

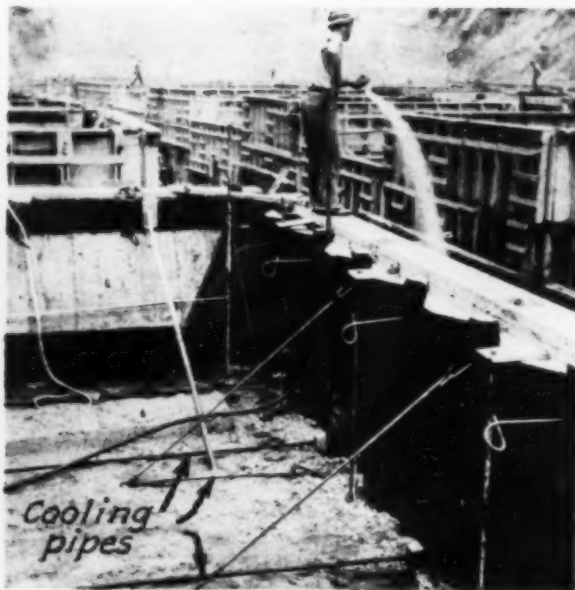
**Cooling**—The unique feature of the concreting placing procedure is the installation of pipes at every 5-ft. lift through which cool water is circulated to remove the heat formed during the setting of the concrete so that the temperature of the mass can be reduced to mean annual and grouting completed within a reasonable time. Because of the mass of the structure, the natural process of heat dissipation from the faces of the dam would require years before contraction would permit final grouting.

The details of carrying out the cooling process were not provided by the specifications and the contractor has arranged, with the approval of the engineers, to use a two-stage cooling procedure. As the first step, water cooled by passing it over the usual type of





DETAIL of side of form, showing grout pipe and outlet, hold-back rods and curved rods for she-bolts at top of lift.



COOLING PIPES of 1-in. diameter are laid on surface of previously poured 5-ft. lift of concrete.



RAISING OF FORMS for 5-ft. lift is done with tripod and chain-jack equipment. In rear, note concrete bucket grounded on surface of block containing horizontal keys.

wooden cooling tower is circulated through the pipe system and when the difference in temperature between this water and the concrete is reduced to the point where cooling is no longer rapid, the refrigerated supply at a temperature of about 40 deg. F. is turned through the same system.

The refrigerating plant is located on the Nevada side of the canyon near the downstream cofferdam and the cooling tower was built on the crest of this temporary structure. Equipment in the refrigerating plant consists of motor-driven compressor units which had previously served in supplying compressed air for construction operations and were changed over for the refrigeration service by the installation of ammonia heads. The refrigeration plant building also contains the pumping units for circulating the water.

From the plant the supply and return headers run to the downstream toe of the dam. These four pipes are 14 in. in diameter and the pipe for the refrigerated water is cork covered to reduce losses. The headers and returns extend up the downstream face of the dam in the central slot and from these, 6-in. horizontal headers extend to the upstream face at every 10-ft. vertical interval.

The loops of cooling pipe left in the concrete consist of 1-in. tubing extending from the central slot into the abutments and return in the form of a closed circuit. These loops of tubing are inserted between each pair of 5-ft. lifts of concrete and are spaced 5 ft. 9 in. apart in a horizontal direction. The original plan was to imbed these pipes into the surface of the concrete at the completion of each lift but difficulties in maintaining the connections resulted in the change and the pipes are now placed on the surface of the concrete just prior to the beginning of the

next lift. On the higher blocks the pipes are extended to the side of the form and left to be connected up as the lower blocks are raised.

Each of the horizontal headers extending between the faces of the structure serves two layers of cooling pipe and is connected by means of rubber hose connections. This type of connection was provided to eliminate the danger of loosened connections as the result of vibration and to make replacement easier in case a connection was broken by material falling down the slot.

The sequence of cooling operations

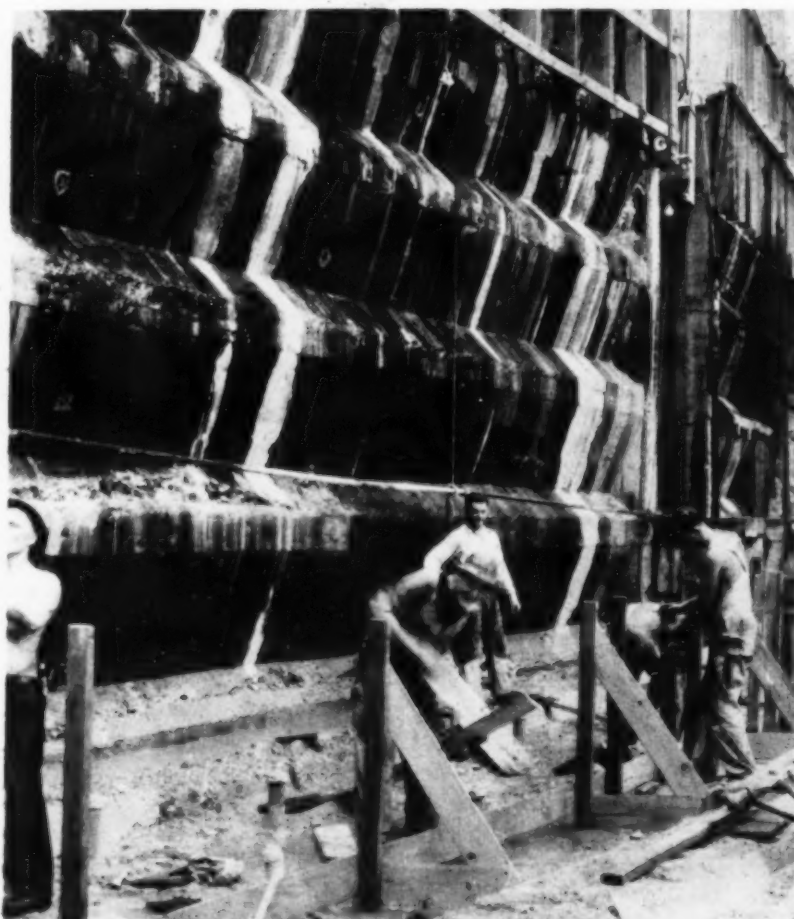
is briefly as follows: The upper 35 ft. of the dam is irregular as the result of the uneven elevation of the blocks and cooling takes place at a satisfactory rate because of the vertical surfaces exposed between the blocks. Below this level the concrete is a solid mass and the extraction of the heat by the cooling water is started. By means of valves in the horizontal headers the cooling water from the tower is pumped through ten lifts of piping, representing a 50-ft. vertical section of dam. After a period of time which will be roughly six weeks this water will be turned out and by means of the cross-connected valves

the refrigerated water will be turned into this same 50-ft. lift of dam. After another period approximating six weeks the concrete will have been cooled sufficiently and grouting operations will be started for this 50-ft. section. In the meantime, the two cooling operations will have been moved up to the next 50-ft. level above. In general this sequence of operations will be continued up to the crest of the structure with certain modifications as the thickness of the concrete decreases.

Also, there will be modifications in the pumping operation as the dam rises in height, including the installation of additional booster pumps to circulate the water at higher levels. After storage in the reservoir is started, and the downstream cofferdam removed, an ample supply of cool water can be drawn directly from the reservoir and there will be no further need for the cooling tower.

**Organization**—Under the general direction of the U.S. Bureau of Reclamation, Elwood Mead, commissioner, Washington, D. C., and R. F. Walter, chief engineer, Denver, construction operations are under the direct charge of Walker R. Young, construction engineer, Boulder City, Nev. John C. Page is office engineer, Ralph Lowry, field engineer, and O. G. Patch, concrete technologist.

Operations of Six Companies Inc. are under the immediate direction of Frank T. Crowe, general superintendent, reporting through a construction committee to the board of directors of the organization. Charles A. Shea is resident director. A. H. Ayers is chief engineer, J. P. Yates, office engineer, B. W. Goodenough, field engineer, and Bernard Williams, assistant construction superintendent.



CONSTRUCTION JOINT KEYWAY formed on both upstream and downstream faces of concrete blocks forming dam.



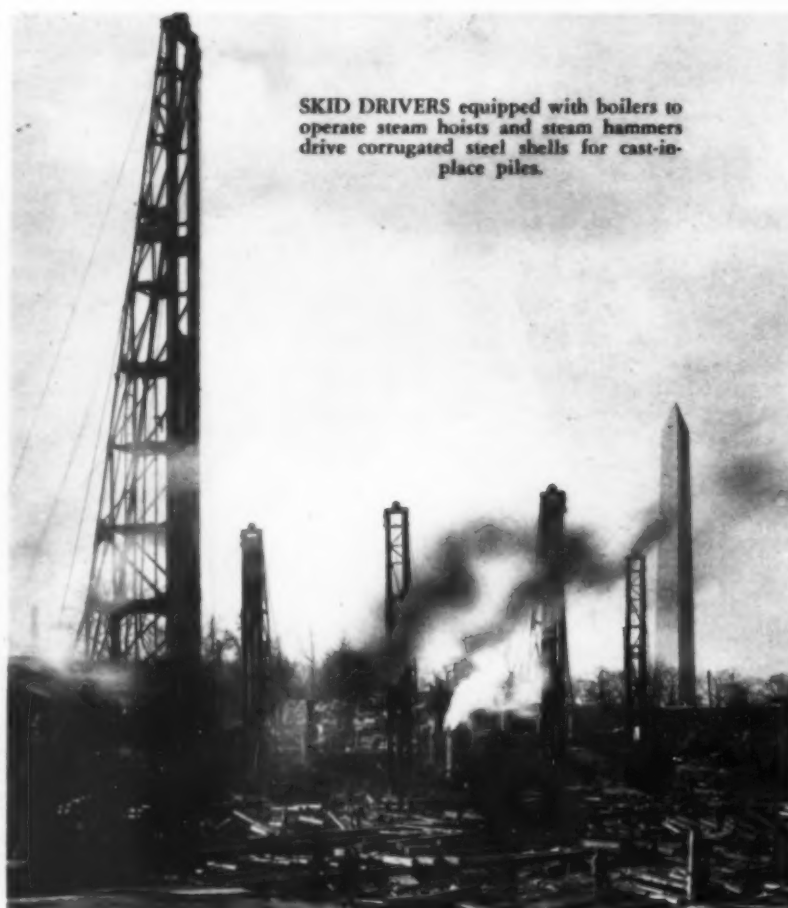
TWELVE PILEDRIERS install 20,000 cast-in-place concrete piles of two types to carry extensive structure housing three government departments in Washington, D. C.

# STEP-TAPERED PILES

## *Penetrate Cemented Boulder Formation*

**S**OIL CONDITIONS substantially different from those forecast by preliminary test borings at the site of the new Post Office Department Building in Washington, D. C., disclosed the advantages of a step-tapered pile recently developed by the Raymond Concrete Pile Co., subcontractor for the piles under McCloskey & Co. of Philadelphia, general contractors for the work. The borings indicated that standard cast-in-place tapered piles of an average length of 23 ft. would provide satisfactory foundations for this building. Piles of this type had been used successfully under the adjacent Department of Commerce and Internal Revenue Buildings, located immediately to the east and west respectively, where the unit loads were about the same as for the Post Office Department Building. After operations at the Post Office Building site had begun, tests and additional information showed that it would be necessary here to drive piles to a greater resistance and penetration than was contemplated in the specifications. The step-tapered pile provided a solution for these unusual requirements.

As indicated by the accompanying plan, the Post Office Department building is the largest of the three connected units which will house also the De-



SKID DRIVERS equipped with boilers to operate steam hoists and steam hammers drive corrugated steel shells for cast-in-place piles.

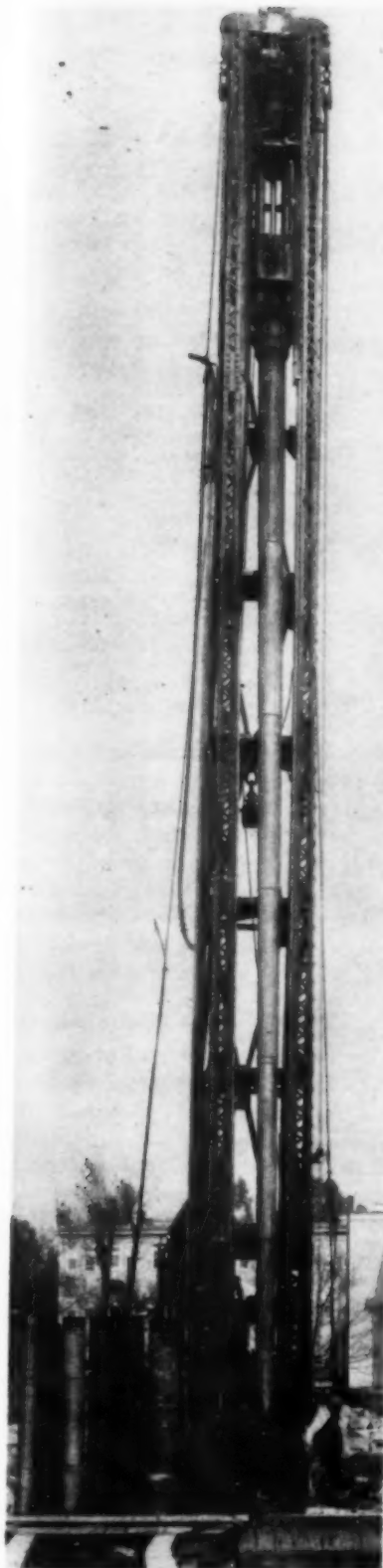
partment of Labor and the Interstate Commerce Commission. The Post Office Department building has a length of about 750 ft. and a width of about 320 ft.

**Soil Conditions**—The areas in which it was necessary to change from uniformly tapered piles to step-tapered piles are indicated on the plan. It will be noted that the southern area extends under the Interstate Commerce Commission building as well as under the Post Office Department structure.

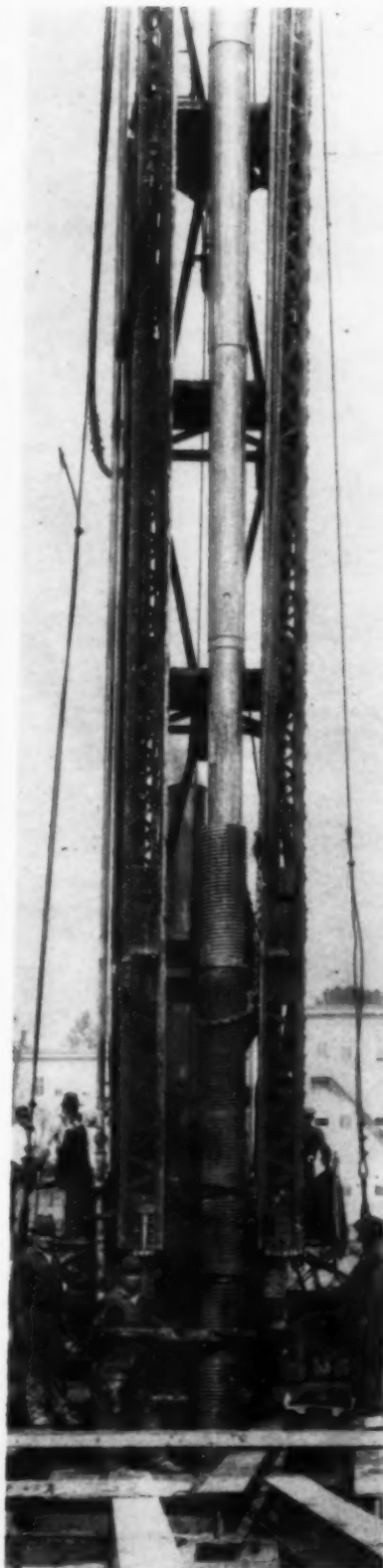
At the north end of the Post Office Department building, in the area marked N, it was possible to secure satisfactory results with a uniformly tapered cast-in-place pile. About 2,000 of these piles were installed in this portion of the foundation to an average depth of about 21 ft.

An entirely different condition existed at the south end of the Post Office Department building, adjacent to the Interstate Commerce Commission unit. This portion of the Post Office Department structure required about 1,000 foundation piles. A condition of structural weakness was discovered in the soil formation consisting of a bed of soft, watery clay silt lying between a thick bed of overlying clay and the surface of the bedrock. In the opinion

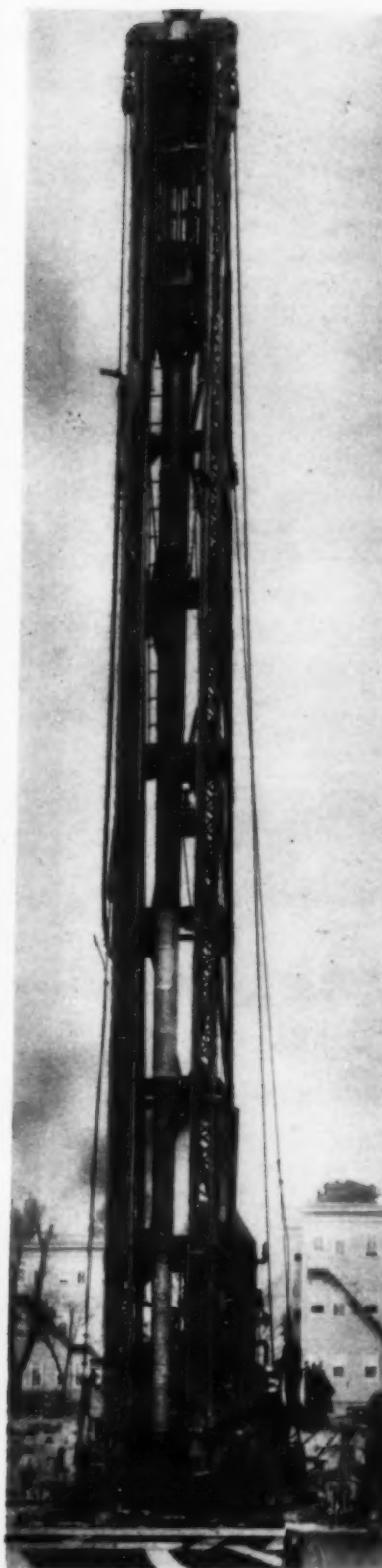




ELEMENTS INVOLVED in driving step-tapered pile include hollow steel core, or mandrel, suspended in leads and group of corrugated steel-shell sections of graduated diameters.



PREPARATORY TO DRIVING, sections of spirally corrugated shell are screwed together to produce continuous step-tapered shell enveloping mandrel.



READY TO DRIVE. Continuous step-tapered shell is made up of 8-ft. corrugated sections increasing 1 in. in diameter at each screwed joint.

of the engineer in charge of construction, this soft bed was subject to a large decrease in volume under a compressive load that would tend to squeeze the water out of it. In effect, the clay layer was floating on the soft material, and would probably sink if loaded with the contemplated building. It was decided to substitute in this area step-tapered piles which were driven to a sufficient depth (about 45 ft.) to obtain bearing in the solid material under the silt.

In the large central area, marked M, between the two portions described, the

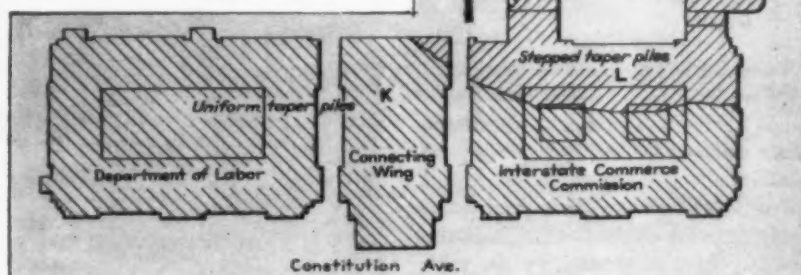
engineers encountered a more difficult driving condition. This area presented a bed of soft clay varying in thickness from 10 to 14 ft. overlying a layer from 4 to 8 ft. thick of boulders from 3 to 24 in. in size, so thoroughly compacted and cemented together with a small amount of sand and gravel as to approach hardpan in density. Under this dense stratum lay a bed of blue clay, 1 to 30 ft. thick, plastic enough to flow under pressure. Below the blue clay layer test borings revealed a solid stratum of sand and gravel overlying rock.

pile before the point reached the solid sand and gravel stratum. Step-tapered piles were substituted and were driven through the boulder stratum to the desired penetration by unusually hard driving. In some cases the boulder formation had to be loosened with explosives. By the addition of a lower section of closed-end steel pipe, step-tapered piles in this area were driven to depths in excess of 60 ft. The central section of the building required 5,500 step-tapered piles.

**Step-Tapered Piles**—A spirally corrugated shell of heavy sheet steel is driven into the ground for the installation of a step-tapered pile in the same manner as for the uniformly tapered type. The standard Raymond pile used elsewhere on the work has a uniform taper of 4/10 in. per foot of length, and the usual point dimension is 8 in. which at the 4/10-in. taper provides a 20-in. butt at a length of 30 ft. In contrast, the step-tapered pile is more slender, and, as its name implies, the taper is provided by stepped increments in diameter. The shell ordinarily is made up of sections 8 ft. long. At a normal length of 48 1/2 ft., the diameter increases from 10 1/2 in. at the point to 15 3/4 in. at the upper section by increments of 1 in. in each 8 ft. It is possible to extend the corrugated sections in lengths of 8 ft. or more to obtain greater penetration to a total depth of 57 ft. when the point diameter is 9 5/8 in.

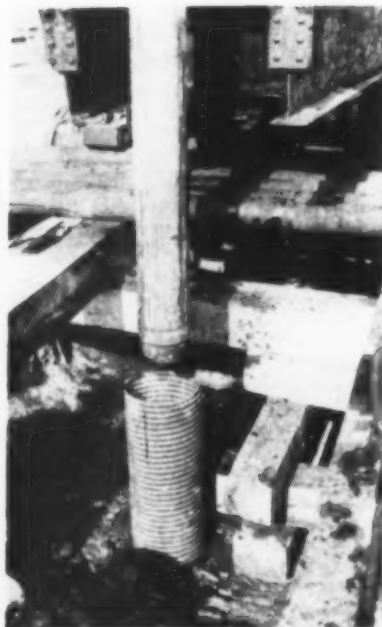
**L-SHAPED BUILDING (below)** is constructed on soils of varying characteristics requiring cast-in-place piles from less than 20 ft. to more than 60 ft. in length. Longer piles are new step-tapered type, required for adequate penetration in areas L and M. Shorter piles of uniform taper are satisfactory for areas K and N.

In this central area, numerous attempts to drive uniformly tapered piles showed that the frictional resistance of the boulder layer stopped this type of

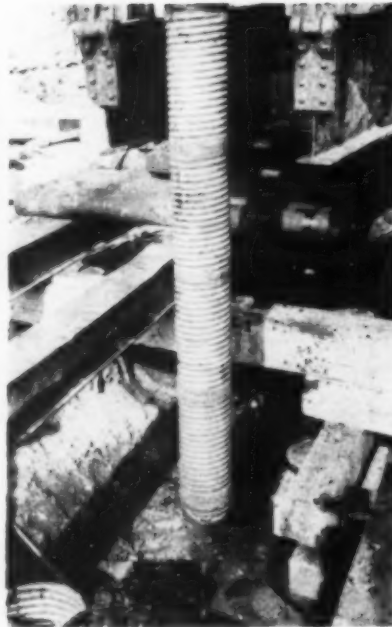




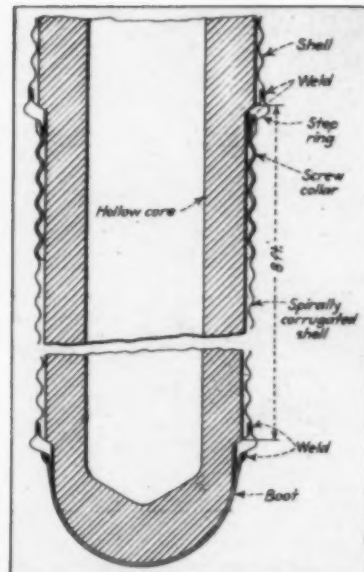
**DRIVING COMPLETED.** Steel mandrel and attached hammer have driven point of step-tapered shell well into firm foundation material.



**CORE WITHDRAWN FROM SHELL** exposes hemispherical driving point and shoulder at lower end of hollow steel forging.



**SPIRALLY CORRUGATED STEEL SHELL** in 8-ft. sections is driven into ground by impact of hammer blows transmitted through steel core to welded rings on inside of sections.



**SHOULDERS OF HOLLOW CORE** rest upon welded steel rings of shell and transmit hammer blows to rings, each of which acts to pull down its section of shell.

Sections are connected by screwing the spirally corrugated sections together until the top of the lower section comes in contact with the shoulder of the upper section. In the step-tapered piles driven at the Post Office Department building, these shoulders were first reinforced with electrically welded steel angle rings.

As an improvement in the shoulder construction, the pile company developed special-section steel rings pressed to accurate dimensions and electrically welded to the shell. The rings extend a slight distance beyond the outside diameter of the shell and open a hole large enough to prevent, in large measure, tearing of the shell by rocks and boulders in passing through coarse formations. In the few cases where a shell was injured, means were provided for redriving and repairing the damage. In driving the steel shell into the ground, the shoulders of the step-tapered steel core, or mandrel, bear directly against the steel rings. The force of the blows is therefore transmitted by the core to these steel rings, each of which then acts to pull down its 8-ft. section of shell. Because of the extremely accurate construction of the shell and steel driving core, it is unnecessary to use a collapsible core in driving the step-tapered piles. The core is a non-collapsible hollow steel forging with a thick wall capable of taking the heaviest blows.

**Penetrating Boulder Formation**—Before starting to drive step-tapered piles through the layer of cemented boulders and gravel, the contractor in some places loosened this dense formation by sinking a well-drill hole at the location of each pile and blasting with dynamite. Each hole was loaded with at least one-half stick of 40 per cent gelatin dynamite, and about six holes were fired at each blast. This preliminary blasting broke up the material sufficiently to permit penetration by the piles.



**CLEAN, DRY HOLE** formed by steel shell is filled with concrete to form cast-in-place pile.



**GROUP OF STEP-TAPERED PILES** penetrating to firm foundation material supplies adequate supporting power for column of building.

It was known that piles in this area would have to be driven to depths of about 60 ft. but the exact length could not be determined in advance. Although step-tapered piles can be driven to depths of 57 ft. by adding corrugated sections, the contractor secured additional penetration by using a closed-end steel pipe extension at the lower end of the pile. This method permitted driving to as great a depth as required and eliminated the necessity of pulling the shell and redriving the pile if a depth of 57 ft. proved inadequate. A 10-in. steel pipe, by means of a special adapter, makes a close fitting connection with the lower end of the corrugated shell on the 48½-ft. core. The bottom of the pipe is closed with a steel casting. Thus used, a 20-ft. length of 10-in. steel pipe provides a pile length of almost 70 ft.

To handle the long piles at the Post Office Department building, the leads of standard Raymond piledriving rigs were extended to 85 ft. by adding 24-ft. sections at the base. A total of twelve piledrivers was employed in putting down 8,500 piles for the Post Office Department building and an additional 11,500 piles for the Labor and I. C. C. structures.

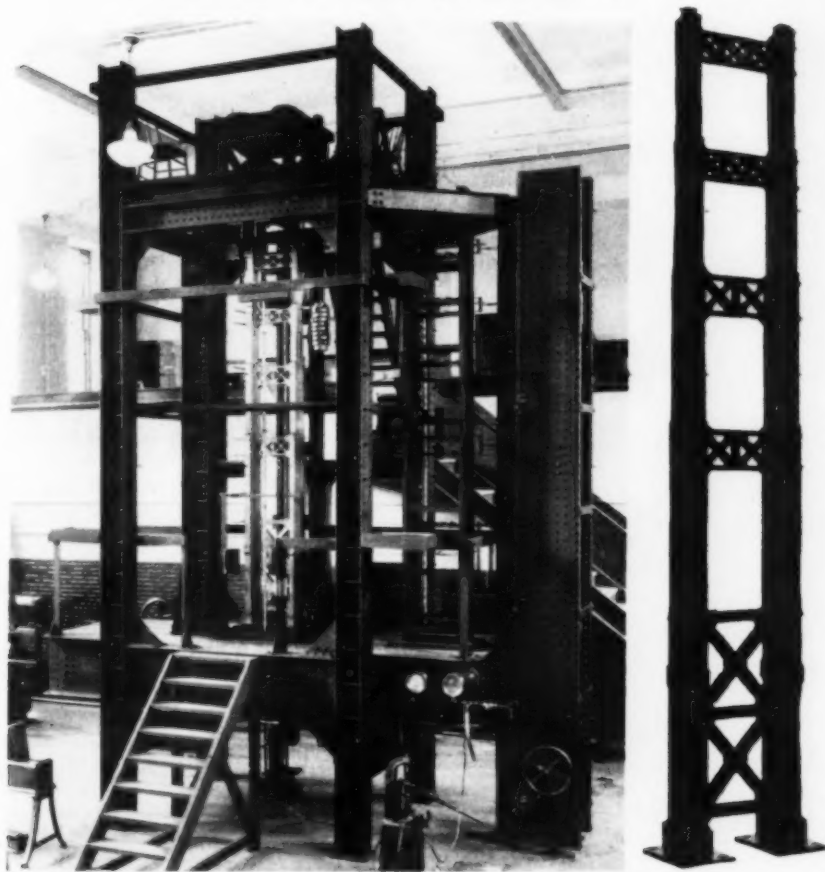
To improve working conditions, the contractor dug deep pits and installed electric-motor-driven well pumps to lower the groundwater table and thereby reduce the hydrostatic pressure. This measure proved effective and in some cases resulted in lowering the groundwater levels as much as 30 ft.

**Supervision**—Acting under James A. Wetmore, supervising architect of the Treasury Department, Neal A. Melick, construction engineer, was in charge of engineering and construction operations for the federal government. James Pinnell, project manager, and Edward Morris, superintendent, directed the installation of piles for the Raymond Concrete Pile Co.



# JOB ODDITIES

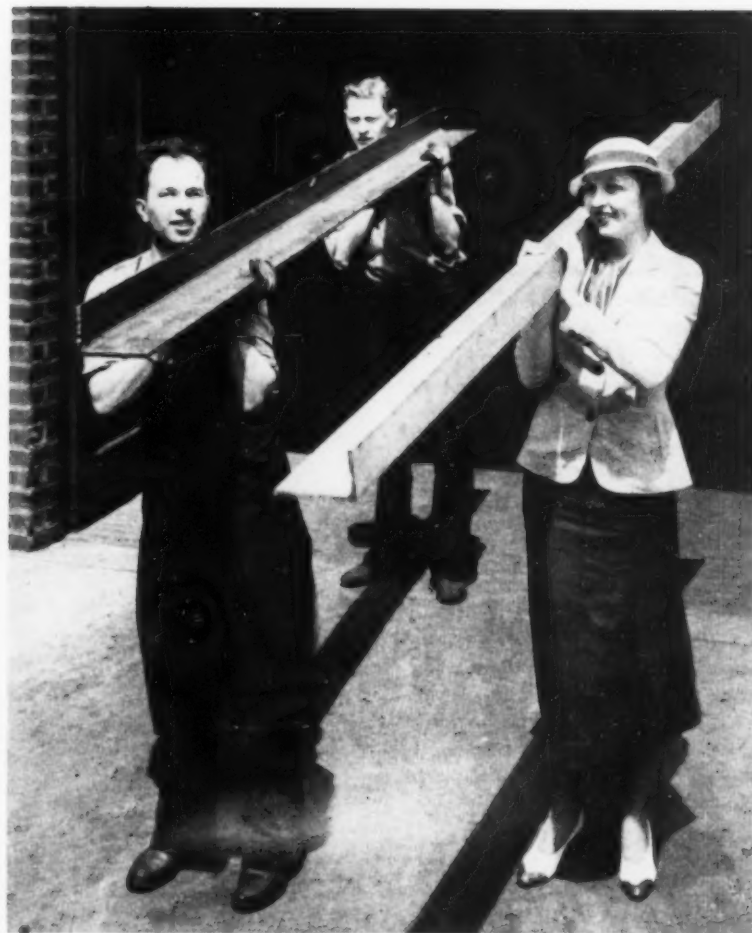
*A Monthly Page of  
Unusual Features of Construction*



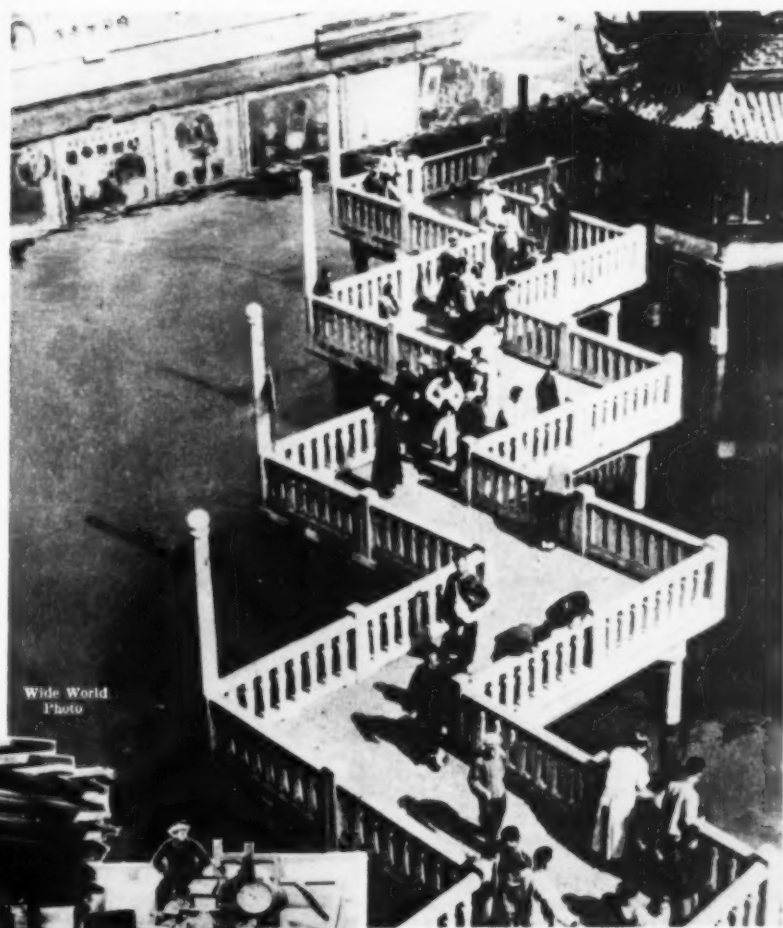
**DEMONSTRATION TEST** on 12½-ft. stainless steel model of one of the 700-ft. towers to support 4,200-ft. suspension span of Golden Gate bridge, San Francisco, is made at Princeton University's School of Engineering laboratory, under direction of Prof. George E. Beggs. Vertical load of 38,000 lb. applied to model by special testing machine corresponds to 120,000,000-lb. vertical load that cables will impose on actual tower. Model, on linear scale reduction of 56 to 1, was fabricated by shot welding. Transverse as well as vertical loads were applied to model during test.

**200-TON TRAILER**, (below) world's largest, is built by C. R. Jahn Co., of Chicago, in shops of La Crosse Boiler Co., to haul 185-ton, 24 ft. long sections of 30-ft. diameter steel penstock for Six Companies Inc., from fabricating plant to cableway at Boulder Dam. Steel frame is built up on two 33-in. I-beams on which are mounted axles and wheels, oil pump, hydraulic steer-

ing mechanism and compressor for air brakes and hydraulic pump. Overall dimensions of trailer are: length, 37 ft. 8 in.; width, 22 ft. Frame is supported by 16 wheels on 8 axles. Trailer weighs 41 tons.



**FEATHERWEIGHT ANGLE.** Aluminum alloy member 12 ft. long, weighing only 52 lb., is easily carried by Miss Martha Jones, while steel angle of exactly the same dimensions weighs 144 lb. and requires two huskies to handle it.



**ZIG ZAG CHINESE BRIDGE.** Oddly shaped wooden structure crosses small lake in Shanghai and connects with one of the city's tea houses.

# Employment for CCC Hand Labor Offered by EROSION CONTROL

By RUSSELL WOODBURN

*Civil Engineer, Kentucky State Forest Service*

**L**ARGE AREAS of farm land in Western Kentucky, laid waste by the inroads of erosion, are being reclaimed by the Civilian Conservation Corps. All work, as described and illustrated by the accompanying photographs, was performed by Veterans' Company 1550 of the CCC, stationed at Camp Hall, Dixon, Ky. Erosion control work at this camp may be said to be typical of the methods in use at the other seven erosion camps in western Kentucky. The construction methods used are not new, being essentially those in use by the U. S. Department of Agriculture and the various state agricultural colleges. Of course, changes have been made from time to time to meet local conditions.

Except for the creek and river bottomlands, the topography is quite hilly. Originally these hills were covered with a heavy forest growth that was cleared away to make farming possible. Without the protection of the forest cover, these lands have eroded badly in the form of gullies. The slopes of the hills range from 5 to 50 per cent, and in all cases observed the size of the gully has no constant relation to the slope of hill. The most extensive gullying seems to be in the range of slope from 15 to 20 per cent. The larger gullies are near the hill tops, and drainage areas of 1 to 3 acres have produced almost unbelievable scour.

Treatment for gullied areas may be classed as mechanical or vegetative and usually a combination of the two. A typical area requires the construction of check dams in the gullies, gully banks sloped to a planting grade and seeded to a protective grass and then the planting of trees, usually black locust.

*Types of Dam*—Dams used may be of the large "soil-saving" type, with drop inlet or protected spillway, or of the

smaller gully check type. Many of the structures in use in Kentucky combine the characteristics of the two classes. Dams in this area are constructed of brush, poles, logs, stone or earth and vary in height from about 2 to 7 ft.

Brush dams consist of two rows of posts, approximately 6 in. in diameter, across a gully, and the intervening space between the posts is filled with well packed brush. Such dams have been constructed more than 200 ft. in length. The pole dam is quite like the brush dam except that poles are laid between the two rows of posts, instead of brush. The log and stone structures are best explained by a reference to the photographs. The earth dam is used to decrease the amount of other materials required and to contribute to the permanence of the installation. It is always used in conjunction with some other type of dam as a spillway. In a typical installation an earth fill may be constructed across a gully. Then the rib at the side of the gully is cut through and a pole or stone structure at a lower elevation is constructed in an adjacent gully.

In connection with the earth dam a rather novel method has been developed by the engineering department at Camp Hall for use where topography permits. An earth dam is constructed across the gully and a spillway trench is cut around the end of the dam along the top of the gully bank. This spillway trench is kept on a low gradient and for further protection against washing is paved with stone.

*Hand Labor*—All work is performed by hand labor using hand tools, with the following exceptions: Materials for use such as brush, logs, poles, stone, straw, etc. are gathered from areas near the dam locations with 1½-ton trucks of the State Forest Service; eight of these



TYPICAL GULLY EROSION in Kentucky which is being checked by work of Civilian Conservation Corps.



FOUNDATION for hand-placed loose stone masonry dam. Cutoff wall extends up into foundation.



LONG DAM DETAIL, showing method of anchorage by recess in bank of gully.



DIVERSION DITCH, 320 ft. long, built in conjunction with stone dam to intercept flow from small gullies.



DYNAMITE SHOT breaks down ribs between gullies. This method is used in bank sloping operations.





**STONE DAM CONSTRUCTION** nearing completion. Storage capacity of 100,000 gal. created by 9-ft. high structure containing 63 cu.yd. of masonry.



**STORAGE BASIN** of 125,000 gal. capacity formed by 7-ft. earth dam across throat of gully. Stone-paved spillway at left.

trucks are assigned to the camp. Teams may be used in snaking logs, plowing down gully banks for planting, or with slip scrapers for earth-dam construction. Explosives are used when necessary for bank grading in the hard clay usually encountered and have resulted in worth while economies.

Company 1550 is permanently housed at Camp Hall, Dixon, Ky. The installation includes four well constructed barracks buildings of 50-man capacity each, frame mess hall, supply depot, recreation room, bath house, 100-ft. well with electric deep-well pump, a 10,000-gal. wood storage tank and two garages. A

**TYPICAL LOG DAM (right)**, showing stone spillway apron. In background, severely eroded area and filled basin. Earth fill behind dam makes it watertight.



frame administration building houses the military organization in charge of the camp and the Forest Service personnel in charge of work in the field.

**Organization**—The workers are divided into squads of 8 men each, in charge of a leader. Three squads are assigned to a work party under the direction of a forestry foreman of the Kentucky State Forest Service for work in the field. Field performance of the individual worker and the efficiency of the organization as outlined above are very satisfactory.

All field work performed by the CCC camp in Kentucky is under the supervision of the Kentucky State Forest Service, with W. E. Jackson, Jr., as State Forester. The commander at Camp Hall is Lieut. H. J. Lang, U. S. Navy, with T. H. Ford, superintendent, for the Forest Service. The design and lay-out of all structural treatment is handled by the writer.



**STONE-PAVED SPILLWAY** for earth dam shown in picture at left. Note characteristics of drainage area.

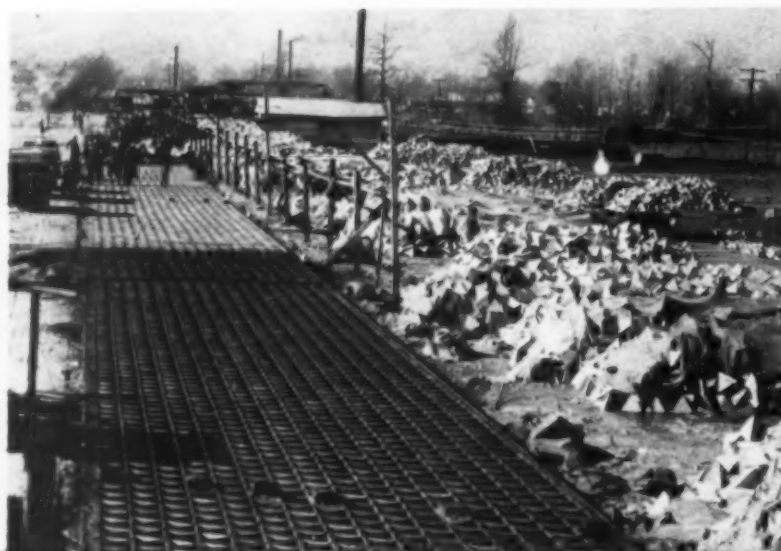
# River Revetment Uses Pre-Cast TETRAHEDRONS

ON NOV. 7, 1933 the United States District Engineer at Vicksburg, Miss., received bids on the manufacture of 6,780,000 four-sided concrete blocks or "tetrahedrons" to be used in revetting the slopes of the Mississippi River south of Memphis. The blocks measure  $14\frac{1}{2}$  in. on a side and have an altitude of 12 in. Specifications required that "the contractor shall employ sufficient crew and equipment to cast and load on barges at least 50,000 tetrahedrons each calendar day. The contractor shall commence delivery of the concrete tetrahedrons on Government barges within 21 calendar days after date of receipt of notice to proceed and thereafter the delivery rate will be at least 50,000 blocks per day until completion of contract. — In case of the failure on the part of the contractor to load the blocks at the rate specified, after barges have been delivered to him, he shall pay to the United States as liquidated damages the sum of \$100 for each lot of 10,000 blocks he fails to load on any one calendar day."

Provision was made in the specifications for use of either ordinary portland cement or high-early-strength portland cement. Should the former be used, a mixture to produce concrete having a strength of 2,000 lb. at 7 days was required. Using the latter, a concrete which would develop 2,000 lb. compressive strength at time of delivery was specified.

Simons-Mayrant Co., Charleston, S.

**TANDEM PAVING MIXERS** (right) each mix batch 45 sec. Concrete is spread and tetrahedrons finished by hand. Calcium chloride solution added in first mixer.



STEEL FORMS for casting tetrahedrons are designed to permit use of paving mixers and other highway construction methods.



C., submitted a low bid price of \$0.0789 per block unit delivered on Government barges at Greenville, Miss. Contract was awarded on Nov. 22. A set of forms was designed to permit the use of paving mixers in mixing and placing the concrete, and highway construction methods in puddling and finishing the units. Individual steel forms were constructed of sheet material and fitted into a nest at ground level, as illustrated. The forms are filled with concrete mixed in two paving mixers in tandem, puddled and struck off by hand. When hardened, the block with the form is lifted from the bed, turned upside down and later struck with hammer to release the block, which is placed in a storage pile extending the full length of the casting bed. Molds are then cleaned and replaced for another filling.

The contractor manufactures 62,500 blocks daily, using 50,000 forms, one-fourth of which are filled twice daily.

From the beginning of the contract the contractor has been using Incor high-early-strength cement in order to permit two fillings of forms per day and to make possible delivery of the tetrahedrons to Government barges within 48 hr. or less. To Jan. 20, the contractor delivered approximately 900,000 blocks. The average 48-hr. strength of 81 cylinders made from Incor cement concrete used on this job is 3,166 lb. per square inch. The Government engineers are not testing cylinders at ages earlier than 2 days.

**AFTER CASTING AND CURING** (below) the four-sided blocks,  $14\frac{1}{2}$  in. long on a side, are loaded on trucks for haulage to river barge.





# Present and Accounted For —

## Officers and Members of Construction Code Authority

VICE-CHAIRMAN—(Below), John P. Hogan, of Parsons, Klapp, Brinckerhoff & Douglas, consulting engineers, New York, also representing the American Society of Civil Engineers. *Keystone*



TREASURER—(Below), F. P. Byington, vice-president of Johns-Manville Sales Corp., New York, representing Asbestos Contractors National Association. *Photo, Blank & Stoller*



CHAIRMAN—Stephen F. Voorhees, member of Voorhees, Gmelin & Walker, architects, New York, and also representative, on the Code Authority, of the Construction League of the United States. *Underwood & Underwood*

A. G. C.—(Below) A. E. Horst, secretary, Henry W. Horst Co., Philadelphia, representing Public Works Construction for Associated General Contractors of America. *Photo, Harris & Ewing*



A. G. C.—(Below) N. F. Helmers, of Siems-Helmers, Inc., St. Paul, Minn., representing Railroad Construction for Associated General Contractors of America.



A. G. C.—Robert E. O'Connor, of J. C. O'Connor & Sons, Fort Wayne, Ind., representing Highway Construction for Associated General Contractors of America.



A. G. C.—Arthur C. Tozzer, vice-president, Turner Construction Co., New York, representing Building Construction for Associated General Contractors of America.



SECRETARY — (Left) James W. Follin, of Washington, D. C., secretary of the Code Committee of the Construction League of the United States.

The Construction Code Authority provided for in the basic code approved by President Roosevelt Jan. 31, consists of representatives of twenty sponsoring organizations. Photographs of the officers and some of the members representing leading construction and engineering associations are published herewith.

A. R. B. A. — (Right) Louis E. Guyott, president, Louis E. Guyott Construction Co., New Haven, Conn., representing American Road Builders' Association. *Bachrach*



# NEW EQUIPMENT

*on the Job*



**75-LB. DEMOLITION TOOL**  
(above) for use in hard, dense concrete or similar material. Valve actuated. Strikes rapid, powerful blow. Overall length with retainer, 28 in. Size of air hose,  $\frac{3}{4}$  in. Sizes of shank (standard)  $1\frac{1}{4} \times 6$  in.; (optional)  $1\frac{1}{4} \times 6$  in. — Chicago Pneumatic Tool Co., 6 East 44th St., New York City.

**VERSATILE FINISHING MACHINE**  
both screeds concrete surface and installs cleft-type transverse and longitudinal contraction joints. Instead of two independent screeds, machine uses one double-channel screed 20 in. wide. This wide screed (insert, above) prevents surface mortar from seeping under it and practically eliminates bumps. Machine is self-adjusting, automatically extending itself on widened curves, eliminating need for third rails. — Flexible Road Joint Machine Co., Warren, Ohio.



**LAYING ORDINARY STRIP WOOD FLOORING**  
without use of nails, wood sleepers or mastic made possible by use of metal channels and clips known as Loxit system. Channels  $1\frac{1}{4}$  in. wide by  $\frac{5}{16}$  in. high with overlapping top edges are laid over sub floor 12 or 16 in. c. to c. Wood flooring is placed in usual manner. Clips with slotted tongues, slipped into channels ahead of last board and driven into place by driving next board, bite into and over tongue of one board and imbed themselves in groove of other, thus securely locking both boards together and to channel. — Knapp Brothers Mfg. Co., 605 W. Washington Blvd., Chicago, Ill.



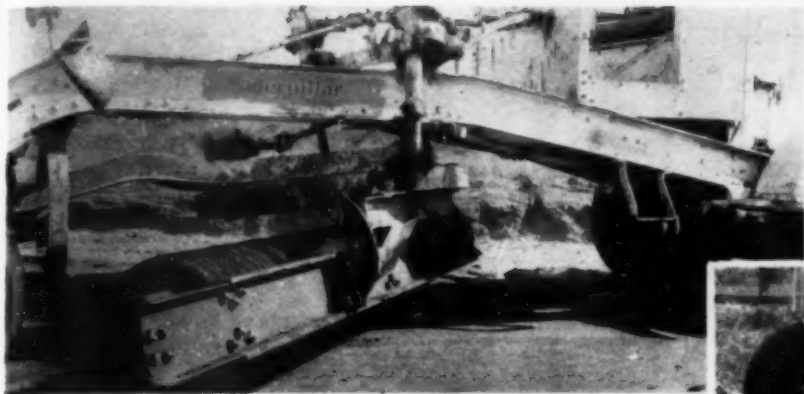
**ROCK GRAB** (two photographs at left) for handling rock or cut stone of practically any size or dimensions. Makes possible tipping or rolling of rock and deposits it exactly in place without resetting or jacking. Releasing closing line immediately frees lifted object. No dog holes necessary. Rubber pads supplied to permit handling of polished stone without marring. Four sizes:  $2\frac{1}{2}$ -, 5-, 10- and 20-ton capacity. — Bucyrus-Erie Co., South Milwaukee, Wisconsin.

**If You Want Further Information—**

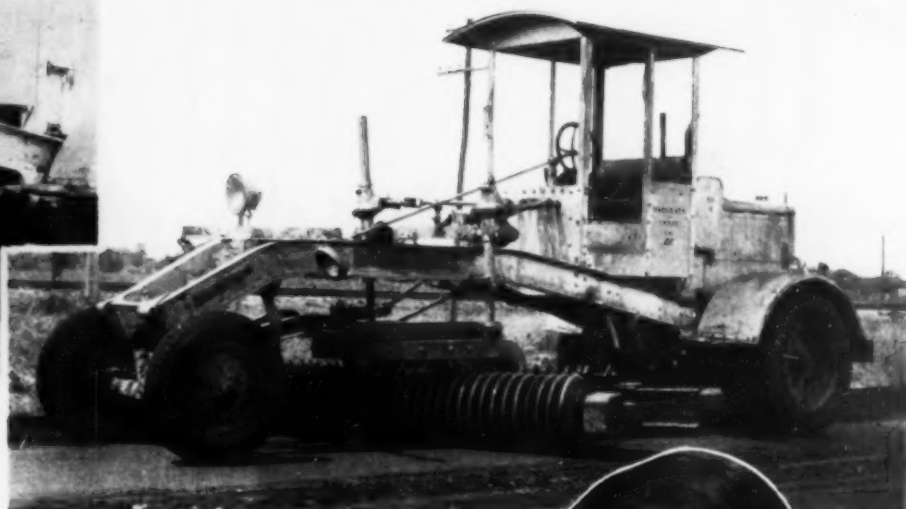
Within the space limits of this page it is impossible to present complete information about the products illustrated.

The manufacturers, however, will be glad to supply further details if you will write to them.





**GRADER-PLANNER** (above and at right) attached to any grader or motor patrol, planes and smooths all types of bituminous pavements including low-cost retread roads, oil-mixed gravel and sand roads and oil-treated earth roads without additional expensive equipment and at minimum operating expense. Consists of 8-in. structural H-beam, 2-in. square steel shaft to which 20-in. diameter disks are held firmly with bearing collars screwed in place; 32 disks with 3-in. spacers or 49 disks with 2-in. spacers may be used. Adjustable hangers permit attachment to motor patrol or grader.—Hargrave Construction Co., Cedar Rapids, Iowa.



**GYPSUM PLANK** (below, right), an incombustible wood substitute for use in all kinds of wood and steel buildings, consists of solid 2½-in. thick and 15-in. wide slab of factory-cast, extra dense gypsum bound with galvanized copper-bearing, tongued-and-grooved steel. Manufactured in three sizes: Gypsteel senior plank 10 ft. long for roofs on spans up to 7 ft. and for floors on spans up to 5 ft.; Junior plank 6 ft. long for roofs on spans up to 4 ft. and for floors on spans up to 3 ft.; Partition plank for partitions, furring and sheathing, made to order in lengths up to 10 ft. Weight, 11 lb. per square foot.—Structural Gypsum Corp., 535 Fifth Ave., New York.

**STAINLESS CURING AGENT** is applied by spraying on concrete surface (below), forming colorless, impervious film that retards evaporation of water in mix during period of hydration. Liquid "Ritecure," having appearance of white paint, is described by its makers as a processed colloidal compound of certain organic materials designed to form a superficial layer over wet concrete without combining with or discoloring the surface. It gradually dries to a varnish-like coating. In addition to highway slabs, applications of the stainless curing medium include structural members, floors, sidewalks and bridges.—Johnson-March Corp., 52 Vanderbilt Avenue, New York.

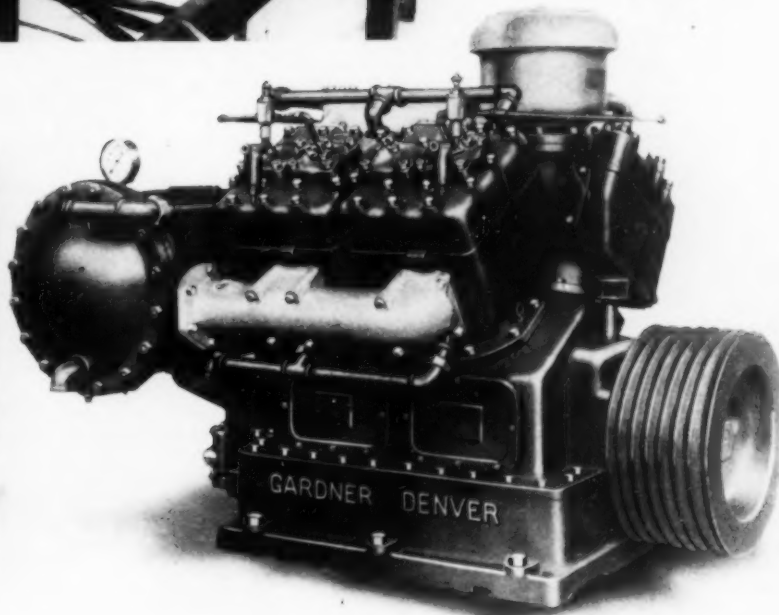


**BOTH FLOOD AND SPOT LIGHTS** produced for first time in one hand flashlight unit (right) by employment of translucent cylinder attached to telescopic mechanism and operated by push button on outside of case. When moved forward by pushing button, cylinder envelops bulb, prevents reflector from utilizing direct rays from light source and produces flood of light. When moved backward into case so

that it disappears behind apex of reflector, bulb is exposed and sharp beam results. Invented by J. H. Kurlander, engineer of Westinghouse Lamp Co., Bloomfield, N. J., who is shown operating flashlight.—Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.



**ECONOMY** in initial cost and in maintenance assured by design of new line of vertical, water-cooled compressors (below) delivering same amount of air as horizontal models of same capacity and priced 25 per cent lower. Installation cost is given as 2/3 lower and maintenance costs from 25 to 50 per cent less. In addition, new verticals make possible valuable saving of floor space. Cushioned inlet and discharge valves. Extra large water jackets surrounding cylinders and valves assure minimum cylinder temperatures. Pressure feed lubrication eliminates oil pipes. Rotary oil pump gives constant and uniform oil pressure.—Gardner-Denver Co., Quincy, Ill.



# "OPEN YOUR EYES TO THIS FAILURE ZONE

IT COST ME \$876 A YEAR  
UNTIL GOODRICH SHOWED ME  
*Triple Protection*"

"\$876 a year lost on tires which could not stand the gaff at the 'Failure Zone.' Rim breaks, sidewall breaks and blow-outs took dozens of our tires out of service long before the tread was worn." It's an old story. Thousands of truck owners have told us of their losses—from the same cause.

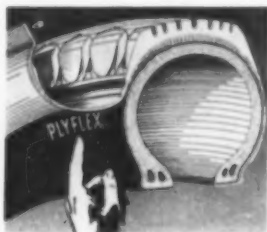
Even if you operate only one truck, the chances are that the "Failure Zone" may claim at least one of your tires within a year. A \$30 tire thrown away after it is one-third worn means \$20 wasted. You can prevent such unnecessary losses by using Goodrich Triple Protected Silvertowns.

Under load, a tire flexes several hundred times a minute. There is a terrific strain on every ply in the tire. Over-loading or under-inflation increases the strain many times. When the brakes are applied, there is an additional strain.

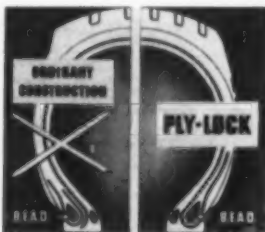
No wonder the short plies break away. No wonder the cords in the fabric break when they can rub against each other. No wonder a break, once started, spreads through the entire sidewall—ruins the tire. Why not make sure that your trucks have tires that wear out—not blow out?

## GET THIS PROTECTION FREE

Silvertowns cost no more than any standard truck tire. Yet they are triple protected. This means that you get the last dollar's worth of wear out of your tires. Here's how it works:



**1 PLYFLEX**—Plyflex is a new tough, sturdy rubber material. Every Silvertown truck tire has a layer of Plyflex protecting the sidewall. It bears the brunt of the strains caused by the tire flexing several hundred times a minute. It distributes the stresses throughout the carcass. It prevents local weakness.

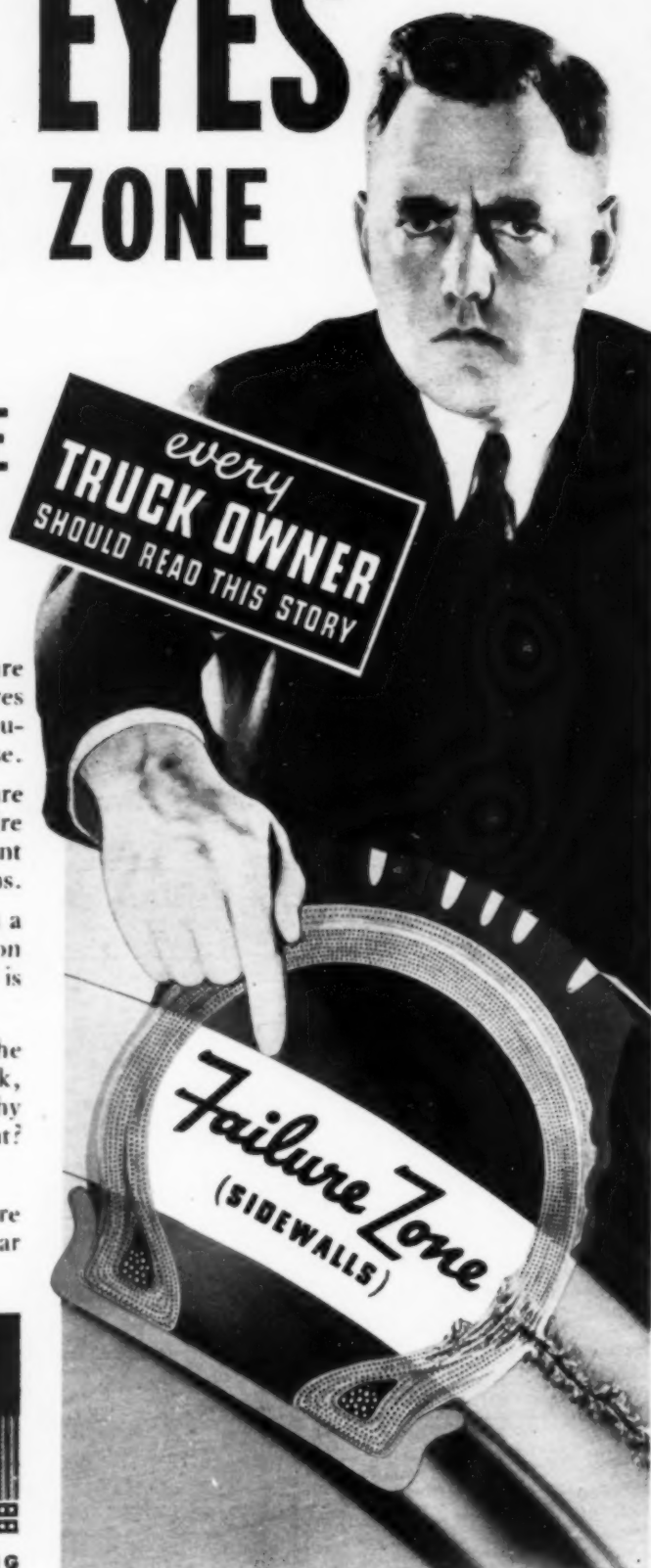


**2 PLY-LOCK**—The short trouble-causing plies in ordinary tires often tear loose just above the bead. A direct result of stresses concentrating at this one weak point. In Silvertowns, the plies are "locked" about the beads—anchored in place. The tapered ply ends are floated in rubber. This is PLY-LOCK.



**3 FULL-FLOATING CORD**—100% floated-in-rubber cord fabric is used in the new Silvertowns. Each cord is surrounded by rubber. With ordinary cross-woven fabric, when the cords touch each other they rub—get hot—break. In Silvertowns there are no cross cords. No friction. Fabric wears longer.

**DON'T DELAY.** Get your tire costs down to rock bottom. See any Goodrich truck tire dealer. He won't ask you to buy a pig in a poke. He will make a free analysis of your truck loads and show you three convincing tests of Triple Protection.



## FREE! 48-page Safety manual.

Tells how to cut accidents—save money—build good will for your fleet. How to get free Silvertown Safety Awards for your drivers. Write Dept. T-72, The B. F. Goodrich Rubber Company, Akron, O.



**Goodrich Triple Protected Silvertowns**  
**FOR TRUCKS AND BUSES**



• 25 •

MILES  
PER HOUR  
TO ANY JOB

DIGS

250 YDS.  
DIRT  
ON 10 GALS. GAS

COSTS

\$1000.00  
LESS THAN  
YOU EVER PAID

*Portable! Profitable! Economical!*

COMPARE THESE FIGURES WITH ANY OTHER SHOVEL OR CRANE



JUST TELL US TO SEND YOU THE BOOK

**"BEAR CAT JR. FACTS"**

**BEAR CAT SHOVEL WORKS**

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THE WORLD'S BIGGEST SHOVEL VALUE

# INSTANTLY...



## A "FINGER PRINT" OF SILVER IDENTIFIES QUALITY!

FINGER PRINTS—positive identification of individual persons—find a perfect simile in the silver colored strand that runs throughout the length of American Steel & Wire Company Monitor Silver Strand Wire Rope. In this case, however, quality is the factor identified—

positive assurance of superior performance and utmost economy. In Monitor Silver Strand Wire Rope—the strongest grade of steel used in wire rope construction assures strength to spare. Also, of great value, are its lightness and abrasion resisting qualities.

AMERICAN STEEL & WIRE COMPANY

# MONITOR

## SILVER STRAND WIRE ROPE

1831



1934

AMERICAN STEEL & WIRE COMPANY

208 South La Salle Street, Chicago  
94 Grove Street, Worcester

SUBSIDIARY OF UNITED STATES STEEL CORPORATION  
AND ALL PRINCIPAL CITIES

Empire State Building, New York  
First National Bank Building, Baltimore

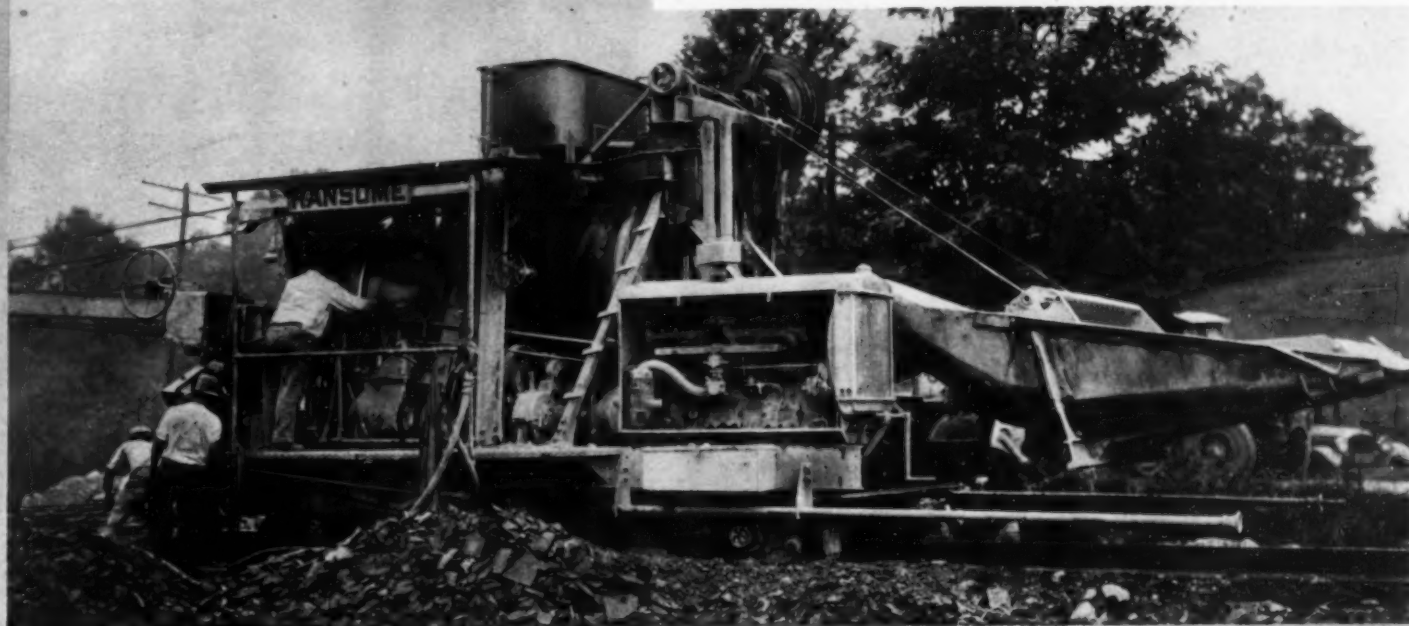
Pacific Coast Distributors: Columbia Steel Company, Russ Bldg., San Francisco

Export Distributors: United States Steel Products Company, New York



# the *Ransome* DUAL DRUM PAVER

the Greatest Advance in Paver Construction since the Invention of the ROAD PAVER



Last September Ransome first advertised the Dual Drum Paver — claiming from 50% to 66-2/3% increase in production over any standard 27-E Paver yet built.

This claim has been further substantiated by additional performance records. For example, on a two lane job in New York a Ransome Dual Drum owned by M. A. Gammino Construction Co. of Providence, R. I., obtained a record of 60% over the average production of a single drum paver in a three day period. ("Construction Methods" January 1934.)

A Ransome Dual Drum Paver operated by Carlo Bianchi & Company, Inc., of Framing-

ham, Mass., on four lane construction in Massachusetts obtained an average of 758 cubic yards per ten hour day in 1933. This is an increase of 70% over single drum paver operation under same conditions.

Ransome Dual Drum Pavers have performed satisfactorily in New England, New York and Texas under varying conditions. What Dual Drums have done for others, they can do for you.

Before you buy a road paver this spring, see a Ransome Dual Drum in operation. You'll agree that it's the greatest advance in paver construction that you have yet seen.



**Ransome Concrete Machinery Company**  
1850—Service for 84 Years—1934  
**Dunellen New Jersey**

**RANSOME CONCRETE MACHINERY CO.**  
Dunellen, N. J.

Please send me your Bulletin — The Dual Drum Paver.

Name.....

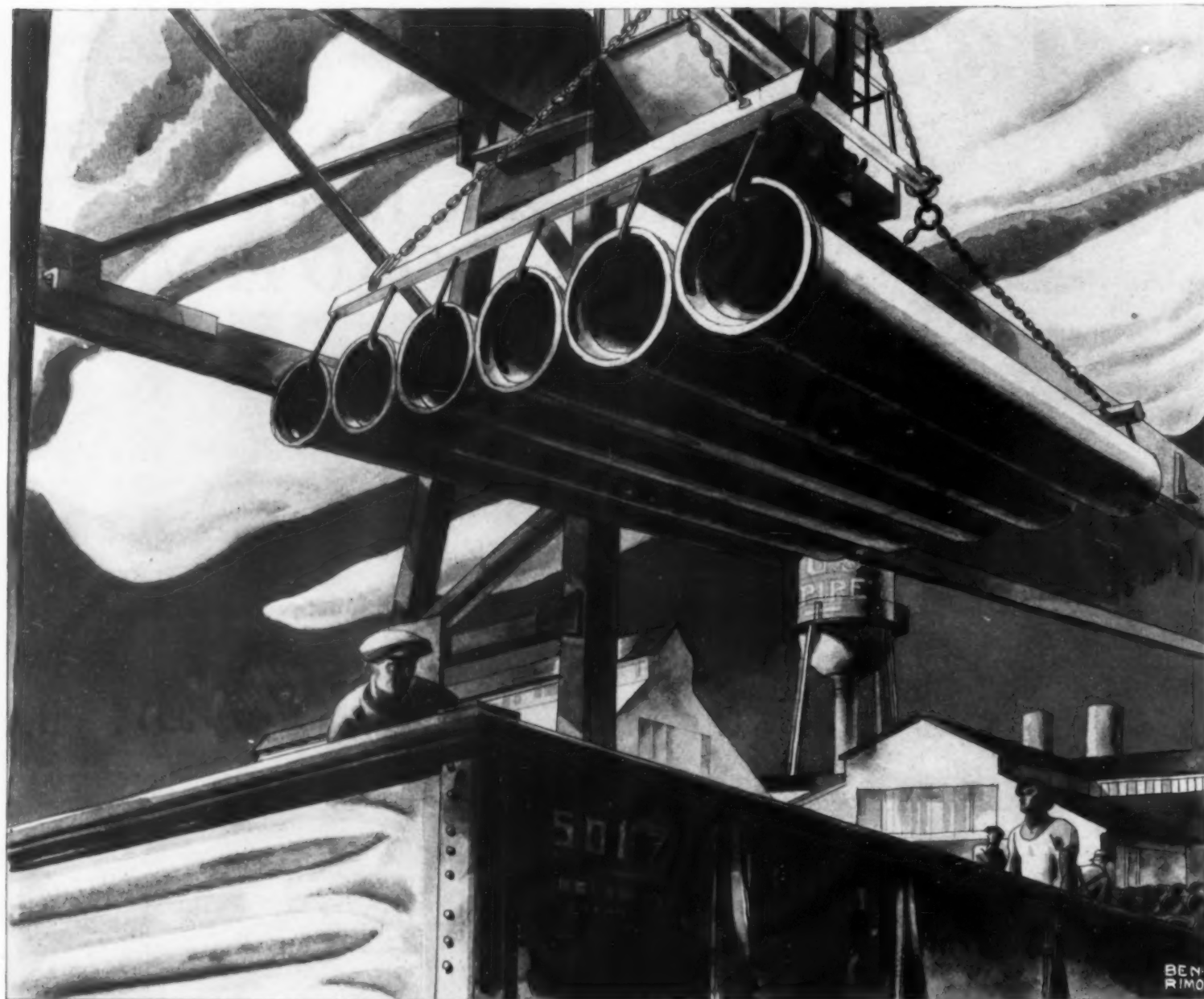
Company.....

Address.....

City..... State.....



# SUPER-DE LAVAUD PIPE



## From The Plant

The United States Pipe and Foundry Company has taken a long step towards reducing the hazard of damage to which all pipe is subject in transit, unloading and distribution. The hazard remains beyond our control but the odds are now overwhelmingly in favor of the pipe. In Super-de Lavaud Pipe we offer a cast iron pipe endowed with maximum protection against handling hazards — a pipe that is *shatter-proofed* to the extent that

### IMPACT-RESISTANCE IS INCREASED 100%

Super-de Lavaud Cast Iron Pipe is centrifugally cast by a patented improved process developed in our Research Laboratory. We have been producing and shipping Super-de Lavaud Pipe for more than a year. It has the same high tensile strength — the concentricity — the self-centering shoulder in the bell — in fact, every advantage and economy of de Lavaud Pipe as hitherto made *plus an extraordinary increase in impact resistance.*



# Means Maximum Protection



## To Under Ground

Thus, de Lavaud Pipe which for 10 years has rightfully been regarded as ideal pipe for service underground now becomes Super-de Lavaud Pipe with maximum protection from plant to underground. With Super-de Lavaud Pipe, the handling hazard is a negligible factor under any but abnormal conditions in transit, unloading or distribution.

It is obvious that this pipe will render super-service underground. It possesses the same high resistance to corrosion for which cast iron pipe is noted. It exceeds in all respects the requirements of the Federal Specifications Board for this product.

*Send for descriptive booklet with complete details.*

**UNITED STATES PIPE AND FOUNDRY COMPANY**

GENERAL OFFICES . . . . . BURLINGTON, N. J.

FOUNDRIES AND SALES OFFICES THROUGHOUT THE UNITED STATES



# ANYWHERE

WORK DONE

# AND BACK AGAIN

BEFORE HEAVIER EQUIPMENT GETS ON THE JOB



## THE AUSTIN CONVERTIBLE BADGER

High speed transport on special wheel mounts partly explains how this small unit can do more *different* jobs on several locations in a day than others of greater weight. But, even on the individual job its quick action multiplies the small dipper capacity until it practically competes with large units. Notice that we haven't called it a shovel. The Badger is fundamentally a controlled boom which with a dipper is converted to a quick and busy shovel—but with a crane boom—becomes a dragline, clamshell, back filler, magnet, or anything requiring the usual crane hook. The universal popularity of the Badger is due primarily to its *extra performance* on a wide range of varied jobs. Send the coupon for a fully descriptive bulletin.

THE AUSTIN-WESTERN ROAD MACHINERY CO.  
Home Office: 400 N. Michigan Ave., Chicago  
BRANCHES IN PRINCIPAL CITIES



# Austin-Western

ROAD ROLLERS, CRUSHING & SCREENING PLANTS, SCARIFIERS,  
SWEEPERS & SPRINKLERS, ROAD GRADERS, ELEVATING GRADERS



MOTOR GRADER  
DRAGS, SHOVELS

The Austin-Western Road Machinery Co.  
400 N. Michigan Ave. A. & Chicago, Ill.  
Please send details about the Austin  
"Badger."

Name \_\_\_\_\_ State \_\_\_\_\_  
Address \_\_\_\_\_  
City \_\_\_\_\_ WAGONS

**Cletrac Tractors**  
Sold and serviced in  
this territory  
by Austin-Western



# REO CREATES NEW VALUE FOR YOUR TRUCK DOLLAR



**B**UYERS need only glance at the specifications to see that the 1½-2½ ton Reo Speedwagon at \$595 represents something entirely new in truck values. A Reo of this size at this figure is wholly without precedent.

It creates a new value for your truck dollar—establishes a buying opportunity that not even Reo has offered before.

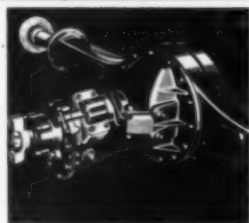
This truck has more than mere price appeal. It is actually a **TRUCK** in every sense of the word—not an assembly of passenger car parts. The exceptional power and long life of the Reo-built

Gold Crown Engine insure a range and regularity of service that has heretofore called for an investment of hundreds of dollars more.

In fact, the entire 15 superiorities with which Reo now challenges the field for low cost truck performance are distinct and *provable* superiorities. Others may equal Reo in a few of the points—but none can match all. Prove this to your own satisfaction by examining the Reo "Book of Superiorities".

*Reo Speedwagons and Trucks range from ¾ to 4-6 tons. New low prices—\$530 and up. 32 wheelbases, all with Reo Gold Crown Engines. Tractor-Trailer units with correct load distribution and maximum payload capacity. All prices chassis f. o. b. Lansing, plus tax.*

**THE QUALITY TRUCK IN THE LOW PRICE FIELD**



The Reo built gasoline-saving two-speed rear axle unit gives you the equivalent of two motor sizes. Greater flexibility and economy for all types of work. Available at only slight extra cost.



The Reo Truck Performance Gauge gives the exact answer as to the truck best suited for your job. Before buying a truck, ask a Reo salesman to use this Gauge to determine your requirements.



## Use This Book In Choosing Your Next Truck!

This book will serve you as an excellent guide in the correct selection of your next truck. In addition to the 15 superiorities with which Reo challenges the field for low cost truck performance, it supplies accurate and invaluable data with which you may compare all trucks in the low price range. Why buy a truck without first looking into the facts and making sure of getting the most value for your money? Write Reo today for the "Truck Superiority Book." No cost, no obligation.



# REO MOTOR CAR COMPANY LANSING MICHIGAN

# Contractor reports phenomenal driving of Inland Sheet Piling



Construction views of La Fruta Dam for City of Corpus Christi, Texas, in which 1700 tons of Inland Section I-27 (formerly ID 16-25) were used. J. L. Simmons Company, contractors. R. J. Cummins & Henry E. Elrod, consulting engineers.

At top: A 79-foot pile suspended with 110-foot boom for interlocking with wall.

THE following excerpts from a letter from the J. L. Simmons Company, contractors for the LaFruta Dam, Corpus Christi, Texas, tells the story of Inland Steel Sheet Piling driving qualities:

"Seventeen hundred tons of your steel sheet piling section are driven to depths as great as eighty feet to cut off the flow of water through certain sand strata under the existing dam. . . .

"Your piling section took the punishment of our 10,000 pound steam hammer under the seventy to one hundred blows per inch of penetration usually required to accomplish this full length penetration.

"We are satisfied the interlock design on these piles has substantially reduced 'driving resistance at the pile point to permit this unusual depth of penetration through solid pack sand, gravel, caliche shale, and sand rock formation."

Such strength, design, and uniform quality explain why so many leading contractors are using Inland Sheet Piling in all parts of the country.

Write for our latest Catalog. Secure the aid of Inland quality and of Inland engineering cooperation on your contracts. **INLAND STEEL COMPANY,** 38 S. Dearborn St., Chicago, Ill.



# INLAND

ABLE SERVANT OF THE CENTRAL WEST

# STEEL

Sheets Strip Tin Plate  
Plates Structural Piling

Rails Track Accessories  
Bars Rivets Billets





# WATER, WATER, EVERYWHERE

## REX SPEED PRIME PUMPS WILL HANDLE IT



**REX 2" SPEED  
PRIME  
PUMP**  
10,000 g.p.h.

**REX 3" SPEED  
PRIME  
PUMP**  
20,000 g.p.h.

**REX 4" SPEED  
PRIME  
PUMP**  
40,000 g.p.h.

**REX 6" SPEED  
PRIME  
PUMP**  
90,000 g.p.h.

All Rex Speed Prime Pumps . . . from the 2" to the big 6" . . . deliver their full rated capacities under all field conditions. Due to the Rex Prime Control which gives them faster priming time. Due . . . to the Rex Recirculation Cut-off which automatically

stops all recirculation of water, once the prime is established. Due . . . to the Rex "Peeler" . . . the one big reason why these pumps give faster priming and greater air handling capacity . . . size for size and lift for lift.

Before buying pumps for any dewatering, contracting, bridge, utility or industrial job . . . write for Catalog No. 240 . . . *Rex Speed Prime Pumps*

*Below—The Rex Road Pump—80 g.p.m. at 500 lbs.—125 g.p.m. at 320 lbs.—enough water and fast enough for any paver, plus sprinkling, plus curing.*



## REX SPEED PRIME PUMPS

*The Most Water for the Longest Time at the Lowest Cost*

**CONTRACTORS:** Before you buy . . . before you bid . . . **INVESTIGATE** the Rex '49ers . . . the complete line of construction equipment made by

**CHAIN BELT COMPANY MILWAUKEE WISCONSIN**

Eastern Office: Room 529 Chrysler Building, New York City • Main Office 1664 West Bruce Street, Milwaukee, Wis.  
Western Office: 909 Harrison Street, San Francisco, Calif. • Distributors in all principal cities

CONSTRUCTION METHODS—March, 1934

CHAIN BELT COMPANY  
1664 W. Bruce St.  
Milwaukee, Wisconsin

Please send me the Catalog—  
"Rex Speed Prime Pumps."

Name.....

Address.....

City.....

State.....

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## THE PLUNGER SHOVEL

**Up to 100% faster in LIGHT cuts**  
**Up to 15% faster in DEEP cuts**

● Here, at last, is the shovel everybody has been hoping for: A shovel combining the advantages of the dipper in deep cuts with those of the skimmer in light cuts. A machine which has made both dipper shovel and skimmer obsolete, because it is more efficient than either of them. The planetary clutches give the flexibility and smoothness of control characteristic of steam power, with none of its disadvantages. The Plunger design, without sacrifice of strength, makes possible almost 5800 lbs. less dead weight on the boom than with the dipper and dipper stick design, adding greatly to cycle speed and payload, day in and day out.

"As far as we can see, this will soon be the only kind of shovel around here," says a Washington, D. C. contractor. "This machine will do everything a dipper shovel will do, and many things the dipper won't do," says another contractor.



### KEYSTONE Builds All Types

The Keystone Model 18 is a full-revolving excavator, equipped as a Dipper Shovel, Plunger Shovel, Trench Shovel, Crane or Hammer. Making both Dipper and Plunger utilities, we are neutral as to choice. Our only interest is to see that you get the utility which will be most efficient for your work. Before you bid on another job, send for the full facts as revealed by an exhaustive study of highway grading projects and excavating costs. Just ask for Bulletins Nos. 2 and 3. Keystone Driller Company, Beaver Falls, Pa., (Established 1882) Branches: Arlington, N. J., Birmingham, Ala., Waukegan, Ill., Joplin, Mo.

### FOUR Shovel Utilities on ONE Boom . . . .

The Plunger, the Trench Scoop, the Clamshell, and the Demolition Hammer, all fit on the same boom. Each change of utilities takes only an hour or two, instead of a day or two. Thus you can do any job that comes up, with the most efficient utility, saving much time and money.

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# KEYSTONE 18

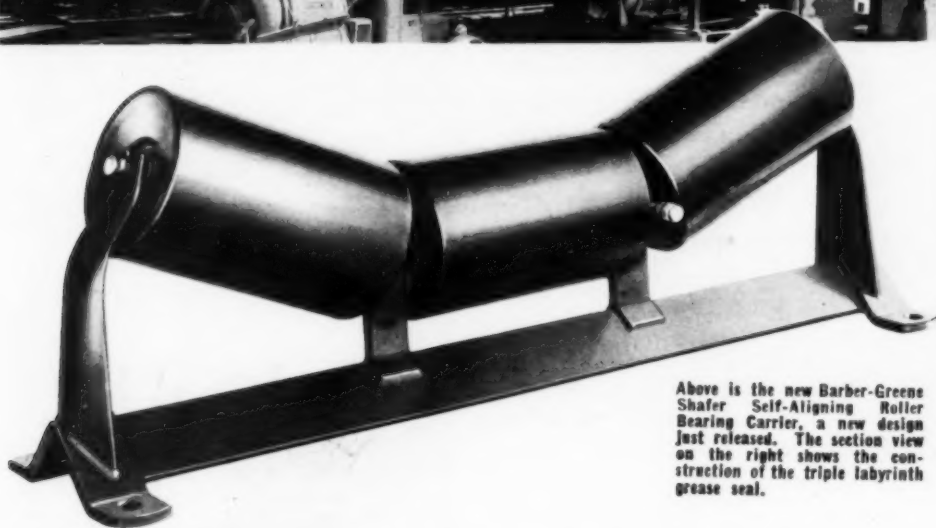
**DIPPER SHOVEL · PLUNGER SHOVEL**  
**TRENCH SHOVEL · HAMMER · CRANE**

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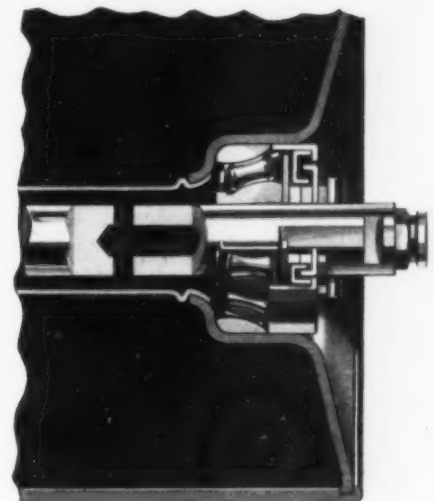
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# Barber-Greene Conveyors



Above is the new Barber-Greene Shafer Self-Aligning Roller Bearing Carrier, a new design just released. The section view on the right shows the construction of the triple labyrinth grease seal.



Barber-Greene Standardized Belt Conveyors are available in practically any length, and in a wide range of widths to meet all normal requirements; with roller bearing, ball bearing, or plain bearing carriers; standard or heavy duty sectional frame; head end or intermediate wrap drive; screw or gravity take-ups; and all necessary accessories.

The B-G Box Girder 30" deep Truss Frame is particularly adaptable to changing set-ups, being extremely rigid, and retaining its alignment when handled.

Barber-Greene customers benefit from the savings of quantity production, the quick delivery of standardized combinations, the interchangeability of parts, the extremely low cost of erection, and the high quality of each thoroughly engineered and proven unit.

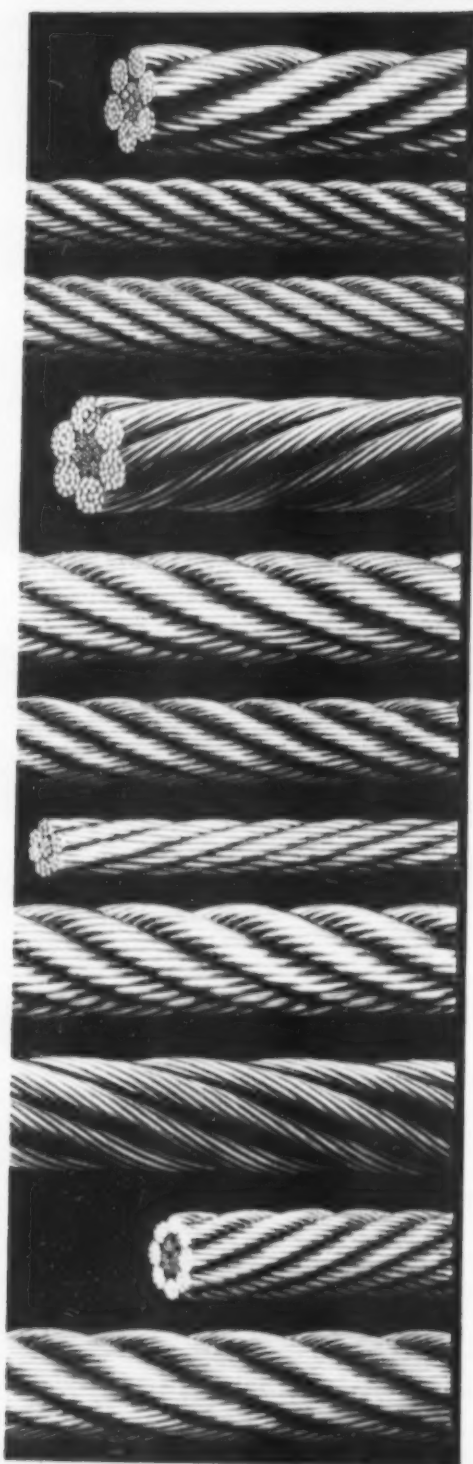
Quotations gladly submitted on complete installations, or any of the Barber-Greene parts. No obligation.

Standardized Material  
Handling Machines

# BARBER GREENE

422 West Park Ave.,  
Aurora, Illinois

# *Preformed* WIRE ROPE IS NOT A LAY... BUT A MODERN PROCESS OF MANUFACTURE



## **LAY-SET** **Preformed** **Wire Rope** *cuts* **operating costs**

LAY-SET is made in all sizes, grades, constructions and LAYS like ordinary wire rope. But you discover the difference when you use the first length of LAY-SET. It handles so much *easier* . . . because LAY-SET wires and strands are preformed in manufacture to the exact shape of the rope. You're handling a *relaxed* rope — seizing is no longer necessary.

In LAY-SET internal stress is eliminated. You get *full rope efficiency* on the job. Thousands of comparative service records prove this!

Preforming insures equal strand balance and reduces fatigue resulting from bending over sheaves and drums by elimination of internal stresses. LAY-SET also resists kinking and is easier to splice. Write today for complete information to

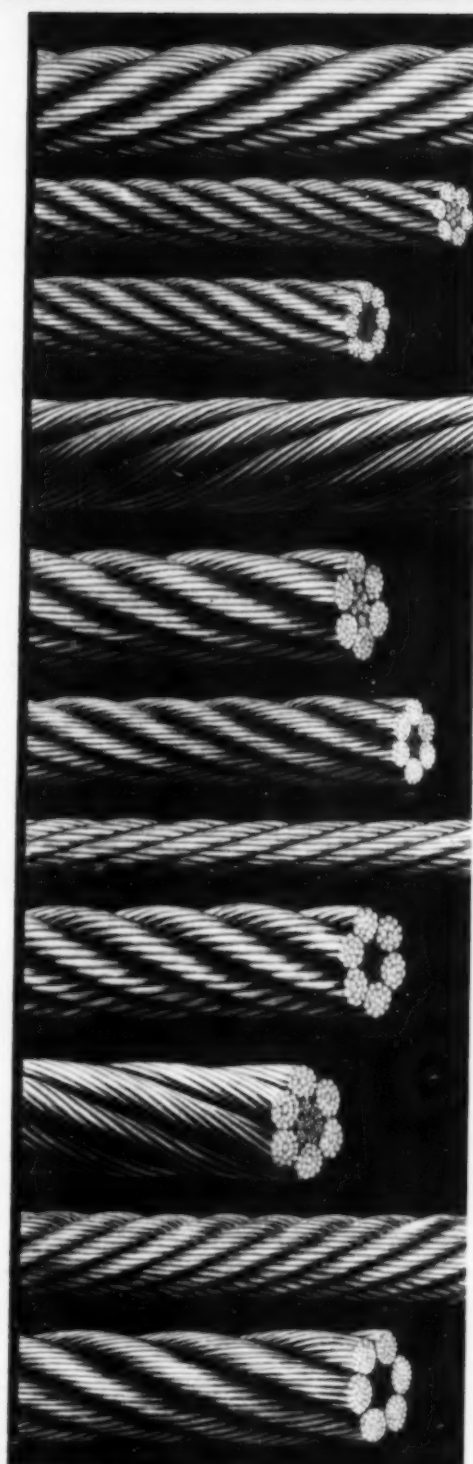
### **HAZARD WIRE ROPE COMPANY**

WILKES-BARRE, PENNA.

New York	Los Angeles
Pittsburgh	Tacoma
Chicago	San Francisco
Denver	Birmingham
Fort Worth	Philadelphia



Since 1846



# **HAZARD Lay-set** **PREFORMED** **WIRE ROPE**





**SIMPLE, PORTABLE TRANSFER PLANT** permits use of dump trucks for long haul, steady, high production from the Truck Mixers—More Yardage per Dollar of Equipment.

## . . This Mobile Jaeger Concrete Plant has solved the **COST** and **OPERATING** Problems of **ROAD WIDENING** . . .

On job after job of widening, the Jaeger mobile Concrete Plant (Side Discharge Truck Mixers with Transfer Loader developed by Jaeger engineers) has proved its ability to place higher strength concrete in the forms at lowest cost, while working miles from the bin set-up and keeping the roadway open to busy traffic.

Entire plant moves with the job. As the haul lengthens, you merely rent more batch trucks for hauling to Transfer Loader. Seven positive advantages result:

**HIGH PRODUCTION**—from small equipment investment, because truck mixers are always on short haul and make more trips per hour. (Two 2½ yd. Truck Mixers will deliver 15 to 20 cu. yds. per hour with 1 to 2 mile maximum haul.) Let the rented batch trucks handle the long haul.

**FLEXIBILITY**—simple to deliver concrete in quantity by Truck Mixer at widely scattered points along job,

**LOWER PLACING COSTS**—mixers discharge direct into forms while moving alongside,

**BETTER CONCRETE**—a recognized Truck Mixer advantage,

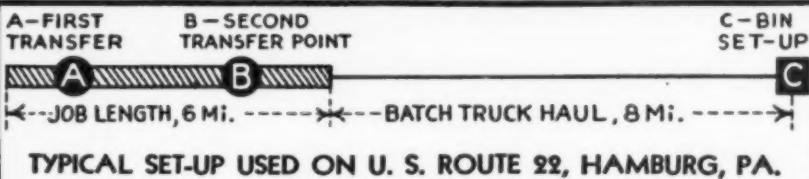
**NO LONG WATER LINES**—Truck Mixers carry Accurate Water Measuring Tanks,

**LOWER JOB COSTS**—due to above savings,

**NO TRAFFIC HOLD-UP**—except while mixers are actually discharging.

Let us send you details of costs and operating data from other contractor's jobs. Mail handy coupon at right hand corner of page.

One of United Concrete Co.'s 2½ yd. Jaeger's discharging direct into forms on U. S. Highway No. 22 near Hamburg, Pa. Versaggi Bros. Co., Wildwood, N. J. and H. A. Miller Co., Lancaster, Pa., were contractors served.



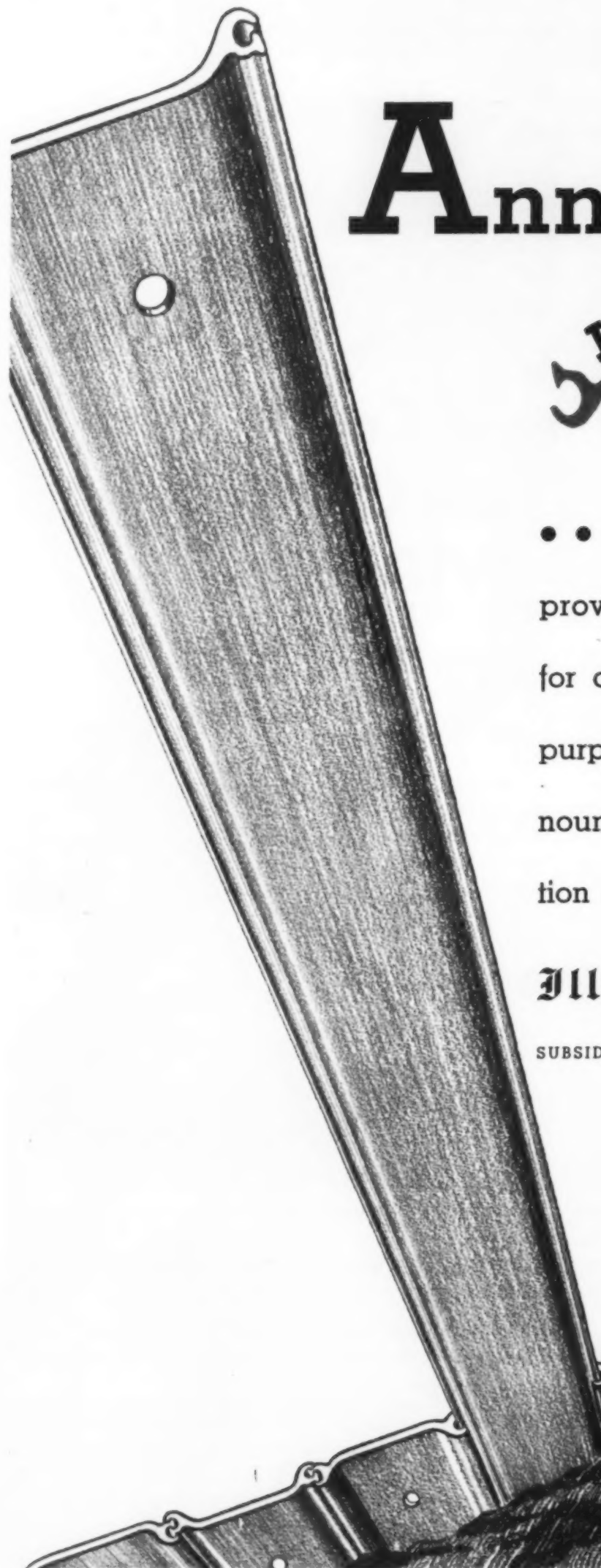
# JAEGER

**THE JAEGER MACHINE COMPANY**  
800 Dublin Avenue, Columbus, Ohio

Send complete data and prices on Jaeger Mobile Concrete Plant for Road Work.

Name \_\_\_\_\_

Address \_\_\_\_\_



# Announcing

## ILLINOIS STEEL SHEET PILING

..... PURSUANT with its policy of providing a Central Western source for all types of steel for construction purposes, Illinois Steel Company announces the inauguration of production of interlocking steel sheet piling.

### Illinois Steel Company

208 S. LA SALLE STREET, CHICAGO, ILLINOIS

SUBSIDIARY OF UNITED STATES STEEL CORPORATION





not all  
*Crawler*  
tractors  
are  
**CLETRACS**

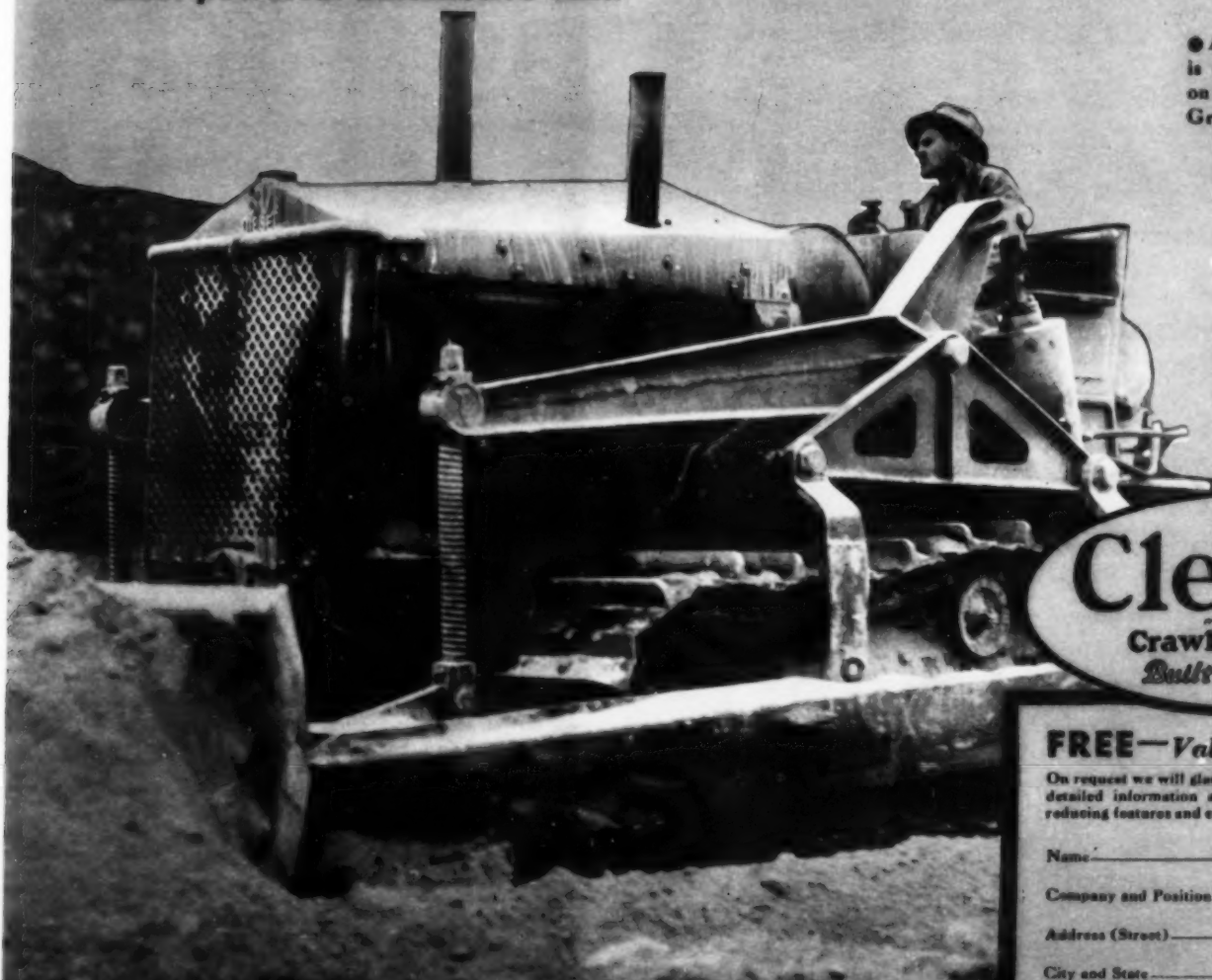
**...THOSE ARE...  
which move the Earth-  
Faster... Cheaper...**

**ON EARTH-MOVING PROJECTS** of every kind, from the lower levees to the mountains of Vermont, from dam building in the northwest to highways in Pennsylvania, Cletracs set new records of speed, economy, dependability.

The reasons are found in Cletrac's program of continuous engineering development—in the 22 exclusive features of design and construction—each aimed at cutting the cost of operation and maintenance—at increasing the life and usefulness of Cletracs for the man who buys them. Investigate Cletrac before you buy—its advanced features will open your eyes to new possibilities for profit on every contract.

Models with horsepower rating of 20, 25, 35, 55 and the giant Cletrac 80, world's most powerful automotive unit.

● A Cletrac 80 Diesel  
is speeding the work  
on Washington's giant  
Grand Coulee Dam.



**Cletrac**  
DESIGNED BY  
**Crawler Tractors**  
*Built To Endure*

**FREE—Valuable Information**

On request we will gladly send valuable literature giving detailed information about Cletrac's exclusive cost-reducing features and examples of their use in road work

Name

Company and Position

Address (Street)

City and State

**..THE CLEVELAND TRACTOR CO.**  
**CLEVELAND, OHIO, U.S.A. CABLE ADDRESS "CLETRAC"**

# CLYDE WHIRLEYS



**CLYDE SALES COMPANY**  
DULUTH, MINNESOTA





## JAEGER SURE PRIME PUMPS



**\$180<sup>00</sup>**  
F.O.B. Factory buys 10 000  
Gal. Size Complete

**BUILT IN 2", 3", 4", 6" SIZES**  
America's fastest selling line of contractors' pumps.  
Write for new catalog, new low prices.  
**THE JAEGER MACHINE CO.** 800 Debla Ave.  
Columbus, O.

## LOWEST HANDLING COST with BAY CITY SHOVELS — CRANES — DRAGLINES




**ONE YARD BAY CITY ON HEAVY-CUT, STATE HIGHWAY JOB**  
This Machine, with chain crowd, frictionless (New Departure) Bearings and Bay City modern design handled an average of 100 yards per day MORE than a competitive 1 1/4 yard machine on the same job and same working conditions.

*Bay City Builds Sizes as Follows*

3/4 yd. Tractor Shovel	3/4 yd. Standard Model 42
3/4 yd. Heavy Duty Model 27	3/4 yd. Heavy Duty Model 52
1/2 yd. Standard Model 30	1 yd. Special Model 52
1/2 yd. Heavy Duty Model K-2	1 yd. Heavy Duty Model 62
	1 1/4 yd. Special Model 62

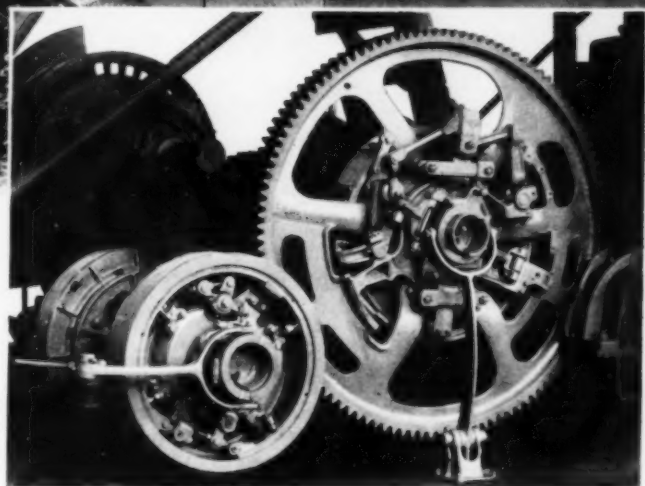
**MODERN DESIGN**  
Honestly Advertised — Fairly Priced  
— FOR 20 YEARS —  
Builders of Dependable Shovels — Cranes — Dredges

**BAY CITY SHOVELS, Inc.**  
BAY CITY, MICH.  
Member—Shovel, Dragline and Crane Institute





# KOEHRING



HYDRAULICALLY CUSHIONED CLUTCH



The Hydraulically Cushioned Clutch sets firmly, without chattering—is positive, without constant adjustments—takes hold of the load with smoothness and ease, eliminating jerking of machinery and physical strain of operators.

## Announcing the New 701- 1 3/4 yd. Shovel

KOEHRING again justifies its leadership in the shovel field through the presentation of the NEW 701—a leadership that has been established and maintained from year to year as a result of outstanding improvements in design and construction.

The Koehring Hydraulically Cushioned Clutch is the latest advance—revolutionary in design, it provides an ease of operation far beyond normal standards.

It will be to your advantage to *know* the Koehring 701—*know* the many reasons why your production will be definitely increased—*know* why you can count on operating results beyond past accepted standards in the shovel field.

*Descriptive bulletin upon request!*

**KOEHRING COMPANY**  
MILWAUKEE Division of National Equipment Corporation WISCONSIN

# 25 Yd.

# LOADS!



## THE 25-YARD EIGHT WHEEL BUGGY

Built to "bulk-handle" rock and earth . . . to stand up to modern big tractor power. A revolutionary idea built around a proven LeTourneau principle . . . namely that of *sliding* heavy loads off the carrying bed, rather than lifting them. The result! A saving in power . . . strain

. . . and time. Will spread load while traveling, or will end-dump.

Cheaper per-yard capacity than any other carrier . . . LIGHTER . . . Built of finest alloy steels . . . All-welded construction . . . Rugged as they come.

Ask our Engineering Dept. for production data and descriptive literature

# LETOURNEAU

R. G. LETOURNEAU, INC.  
Wilson Way at Roosevelt  
P.O. Box 1290 Stockton, Calif.



## Cable Loads are Money Loads—

Money saved when they are right, money wasted when they are wrong.

You can check the load on any line on the Job with a Martin-Decker, Shunt Type Tension Indicator, quickly and accurately, without dead-ending or cutting.

Two sizes—for cables 1/4" to 2 3/8" in diameter; loads up to 260,000 pounds.

Write for descriptive literature

**MARTIN-DECKER CORPORATION**  
3431 Cherry Avenue, Box 249 Long Beach, Calif.  
U. S. A.



## with NATIONAL CARBIDE LANTERNS

Lights a stalled truck and shows a red light to warn oncoming traffic



Place one of these Lanterns the required distance from the truck, on each side. Each lantern has a red safety lens in the rear. You get perfect two-way protection. This is only one example of the many kinds of service these sturdy, simple lanterns give. Lamp holds enough National Carbide and water for 8 hours continuous lighting.

Other National Carbide Products:  
National Carbide V-G Light 8000 cp.  
National Carbide V-G Handy Light 1500 cp.  
Manufacturers of National Carbide "In the Red Drum"

**NATIONAL CARBIDE SALES CORP.**  
LINCOLN BLDG. NEW YORK, N. Y.



# All helps to SUCCESSFUL CONTRACTING

Novo Equipment is always the choice of the wise, experienced, contractor. Each item has proven itself hundreds of times in jobs just like yours.



The 6" Novo Injecto Prime Self Priming Centrifugal Pump—Has a capacity of 90,000 G.P.H. There is also a 4" giving 40,000 G.P.H., a 3" with 20,000 G.P.H. capacity and a 2" which delivers 10,000 G. P. H.

**DEWATERING PUMPS:** The New Novo (Injecto Prime) Self Priming Centrifugals, Diaphragm Pumps and Standard Centrifugals.

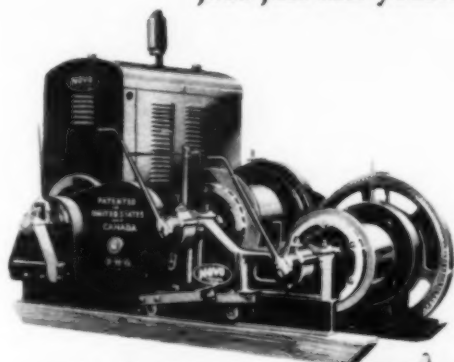
**PRESSURE PUMPS:** General Water Supply Pumps, Road Pumps and Jetting Pumps.

**DRAGLINE HOISTS:** The most economical method of taking out gravel and handling materials.

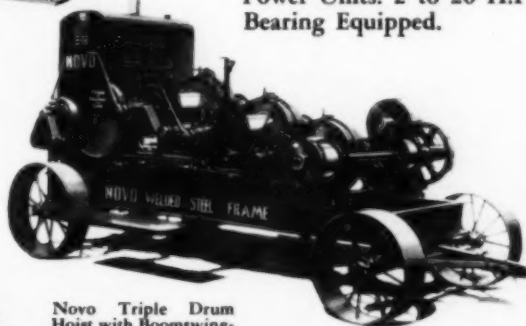
**BUILDERS HOISTS:** Single, Double and Triple also Triple Drum with Boom-swingers for general hoisting, pile driving, clam shell bucket work, steel erection, etc.

**LIGHT PLANTS:** Engine Driven Generators supplying current for lighting the night crew and for small electrical tools.

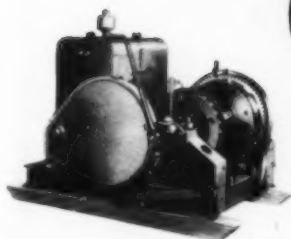
**ENGINES:** Single, Two & Four Cylinder Power Units. 2 to 20 H.P. All Timken Roller Bearing Equipped.



Novo Dragline Hoist— $9\frac{1}{2}$  cu. ft. to  $2\frac{1}{2}$  cu. yd. capacity, for dragging, stripping, conveying & storing.



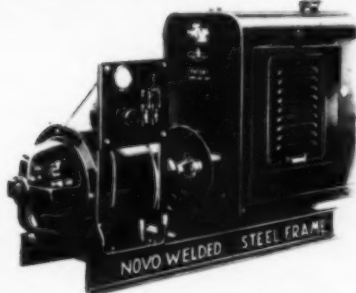
Novo Triple Drum Hoist with Boomswinger, truck mounted—Bridge builders and steel contractors hoist.



Novo Single Drum Hoist: 2 to 100 H.P. Also Double Drum Hoists.



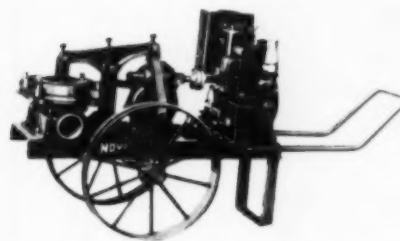
Novo 4 Cyl. 20 H.P. Roller Bearing Equipped Gasoline Engine—Also Single and Two Cyl. Power Units.



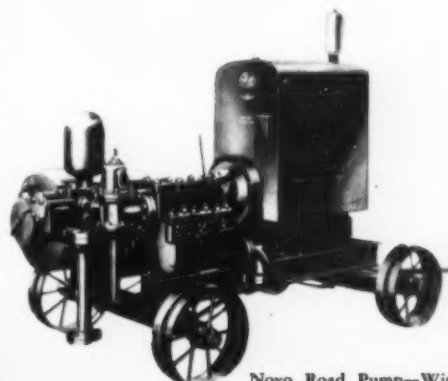
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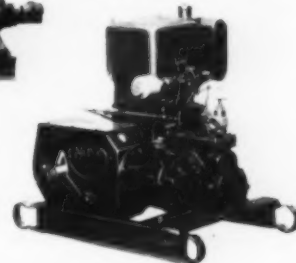
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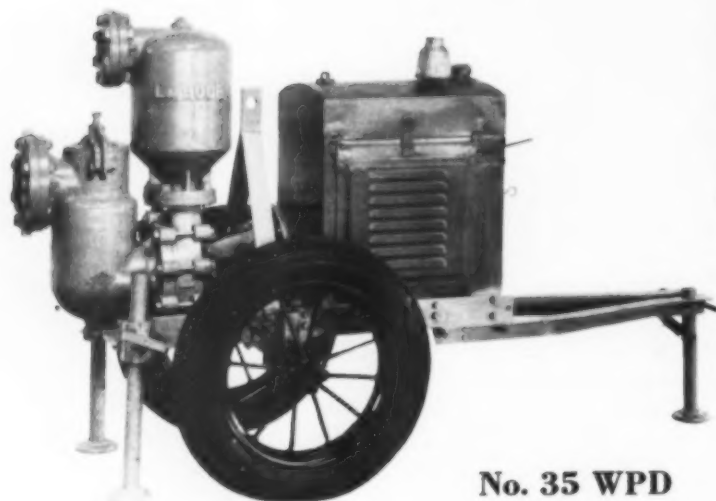
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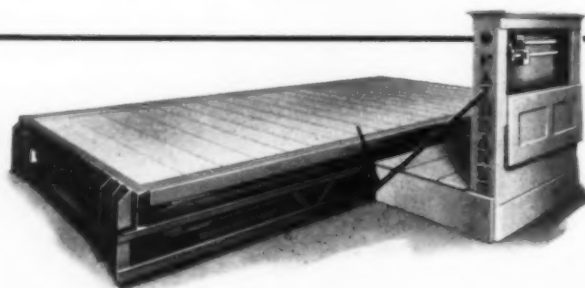
The LaBour Company has recently published a handbook of standards and testing techniques which may be applied to all self-priming centrifugal pumps. This is not a piece of advertising, but is a compilation of technical data which should be useful to all who buy, build or specify pumps of this type. A copy will be sent without charge at your request.

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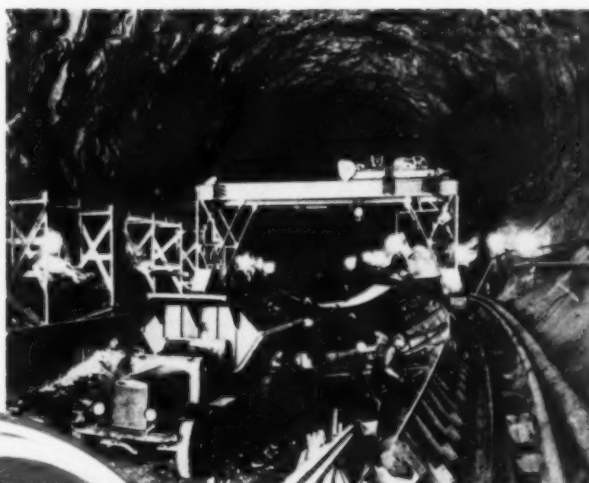
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ABOVE: Concrete-handling at Pine Canyon Dam, near Pasadena, California, was facilitated by this large twin cableway. Built by Lidgerwood. Equipped with General Electric motors and control.

BELOW: When this 133-ton girder was hoisted into place at the N. Y. Post Office Addition, G-E motors supplied the power; and G-E control and G-E Thrustor brakes protected job and workmen.

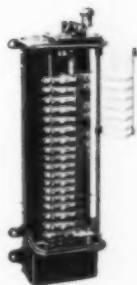


ABOVE: Fast, economical handling of concrete for lining the diversion tunnels at Boulder Dam was materially assisted by this Shepard-Niles gantry crane and its reliable G-E motors and control.

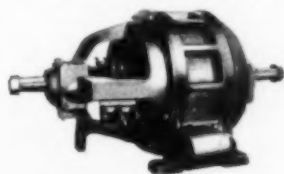
BELOW: Hydraulic excavating, reminiscent of the old placer method of mining, helped to prepare the site for Pine Canyon Dam. The pumps were built by Byron-Jackson, motorized by General Electric.



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Here is an a-c. drive combination that you can use to advantage for many construction applications—a G-E Type MTC wound-rotor induction motor and its heavy-duty control equipment.



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# GENERAL ELECTRIC

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This introduces to you a new advertising section. Through it we hope to serve you more thoroughly. That is why it is called the "Service Section". The new, small, units of space available here provide opportunity for presenting many additional products and services not heretofore brought to your attention. To be informed — and reminded — of these further aids to efficient and economical construction operations we suggest that you check this section regularly.


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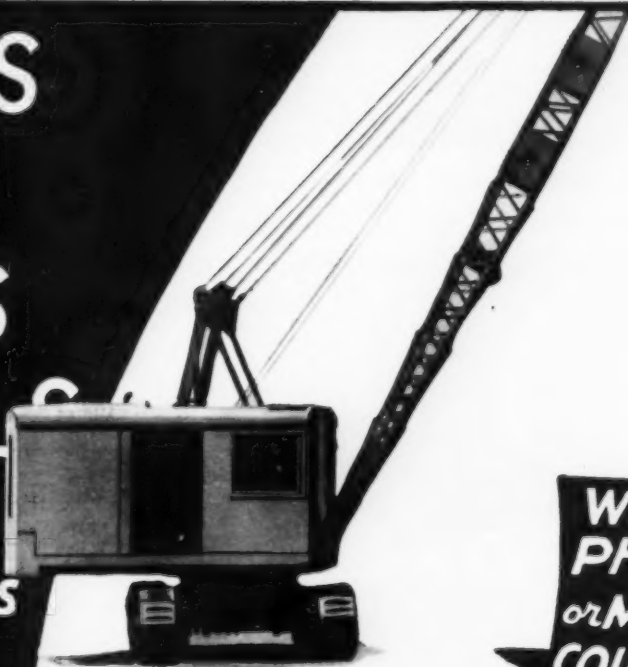
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Perhaps this is the solution to the problems in that job you are figuring.



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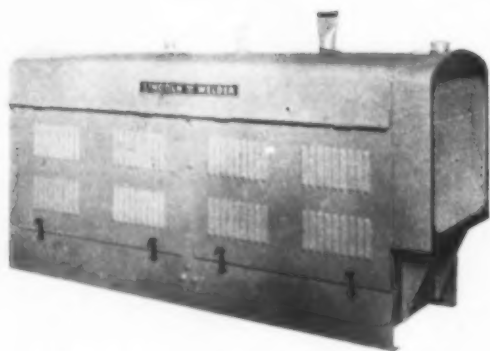


 "Cast your eyes, Lad, on this water line, the largest all welded lines in the west. The pipe ranges in diameter from 80 inches to 94 inches with wall thickness as heavy as 1-1/16 inches. Such heavy pipe is required by the 400 pounds per square inch pressure to which some parts of the line will be subjected in operation.

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 "Yes, Pop, but do you know that the pipe was also fabricated by the shielded arc process?"

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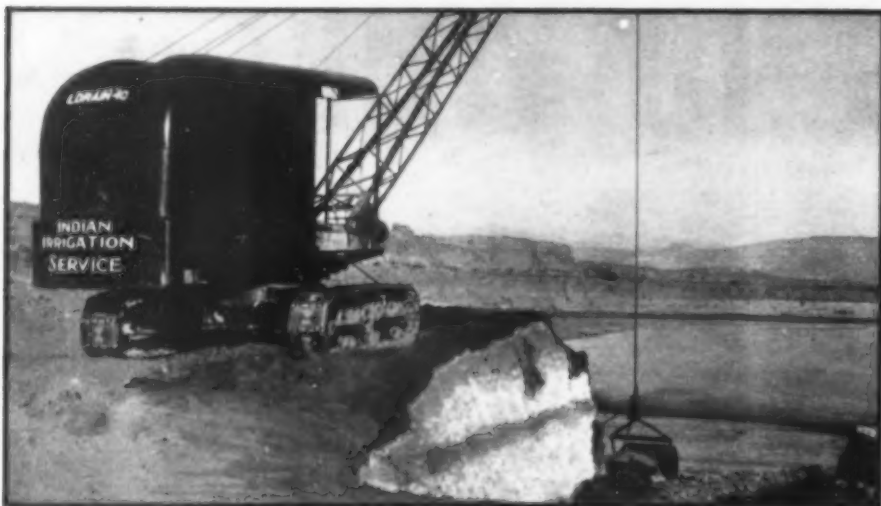
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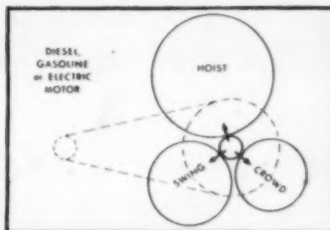


**I**T TAKES A LOT OF THINGS to make a good dragline, shovel or crane. An unexcelled basic design—like Thew Center Drive—is only a start. It must be followed through—as Thew has—with constant improvements and refinements. Saving a split second here—eliminating a motion there—further simplifying a part—that's what Thew has done on the 1934 Lorains. Each improvement is designed for—*greater production*—or—*less operating cost*—or—*greater freedom from breakdowns*—or—*reduced maintenance expense*. Add them up and Lorains will continue to move more dirt at greater profits in 1934.

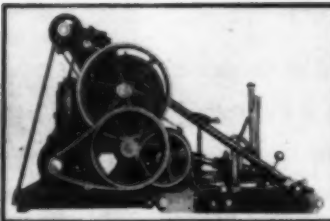
## LORAIN-75B-40-37-30

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THE UNIVERSAL CRANE COMPANY • LORAIN, OHIO

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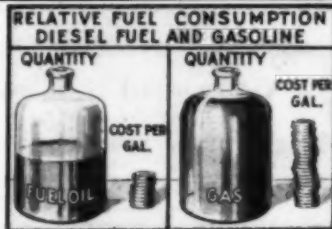
### CENTER DRIVE • DIRECT POWER AND SIMPLICITY



Center Drive design also permits proper grouping of the resulting simplified machinery to permit using its weight to the maximum to counter-balance loads lifted. Capacity and strength without excess weight are proof of thorough, exacting engineering.

### BALANCED DESIGN • CAPACITY AT MINIMUM WEIGHT

A Diesel of new, simplified design, correctly engineered into the L-75B cuts fuel cost 50-75%; increases production at least 10%. Comparable fuel economy is available in the L-40-37-30's by use of oil-burning Hesselman engines.



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